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Central-Station Earnings Still Gain

THAT earnings of central stations in December, 1914, were better than in October and November, as compared with the corresponding periods of the previous year, is the encouraging fact shown by the ELECTRICAL WORLD returns printed elsewhere. Under prevailing conditions the absence of declines in business is a fine sign of inherent strength. When there are no declines but actual increases are registered, they are stimulating. The diversity of the territory covered, the fact that the returns cover approximately 65 per cent of the industry, and the undeniable historic immunity of central stations from severe depression support the conclusion that the figures are fully representative of the industry at large. It is not reasonable to expect an unbroken continuance of the great gains of normal years, but the record in five months of the European war period shows that central stations have upheld the tradition of well-sustained earning power.

Car-Lighting Problems

IN a paper read before the New York Section of the Illuminating Engineering Society Messrs. W. C. Gove and L. C. Porter reported the results of a practical study of car-lighting problems with reference to the cars for the new subway in New York City. Several lighting equipments were installed in a car and compared before a conclusion was finally arrived at. According to the equipment selected, use is made of a single row of 56-watt tungsten lamps along the central line of the ceiling, each lamp being bowl-frosted and placed in a white-glass reflector, so that the glowing filaments are not exposed to the eyes of the passengers. The horizontal illumination provided at desk surface along the car appears to have averaged nearly 6 ft.-candles at normal voltage. Of course, in service, with old lamps and dusty globes, the actual illumination may be regarded as likely to fall off to a third or a quarter of the values obtained with everything new and bright; but, even so, the resulting illumination should be adequate for practical purposes. The power consumption for this result is stated at less than 1.5 watts per sq. ft., which speaks well for the plan.

Telephone Manufacturing Conditions

THE status of the manufacturing part of the industry last year cannot be gaged by one company alone, but the sharp fluctuations in trade conditions make individual experiences specially illuminating. The Western Electric Company's gross sales in 1914 were 14.4 per cent below those of 1913. Conditions are explained in the annual report and in still more detail in the report of the American Telephone & Telegraph Company, both issued this week. Manufacturing conditions became steadily worse, and some losses of profits and property in foreign investments are expected. The manufacturing company is the purchasing agent and storekeeper of the Bell telephone system, and hence it is not surprising to find that two-thirds of the gross sales of the manufacturing company were to Bell companies. This does not mean that the same proportion prevails in normal times. Many outside construction programs were cut radically. Bell telephone plant additions, which were estimated at the beginning of 1914 at $56,000,000, were reduced to $50,000,000 by business curtailment. The telephone expenditure for current additions in 1915, estimated at 70 per cent of last year's figure, represents a conservative view under conditions now prevailing.

The Consolidation of Water-Powers

AN excellent example of economical utilization of widely distributed water-powers is given in the account of the new hydroelectric development at Cohoes, N. Y., in the current issue. The company which has been undertaking the work has owned at Cohoes a dam and a canal system on various levels, supplying power to a considerable number of industrial plants after the fashion common before electric transmission had really made a place for itself. With the present development completed the main drive will be electrical and no water will hereafter be taken from the canal. Of the two existing small hydroelectric stations, one will be held in reserve and the other adjusted to the new conditions. A new consolidated power station has been erected near a natural fall in the Mohawk River below the old dam of the Cohoes Company, the total available head of the new development being just short of 100 ft. This head is utilized in three units, each fed by an independent 11-ft. penstock. Each waterwheel is of the vertical-shaft type, developing 10,000 hp in a single runner and driving a 9000-kva, 12,000-volt, three-phase generator. The system is operated at the now somewhat unusual frequency of forty cycles per second, a frequency which our readers will remember was developed with special reference to mill work, for which it gave somewhat favorable motor speeds. The distribution system is also somewhat out of the ordinary, the existing Cohoes equipment being of the two-phase type, operated at 2300 volts. The new plant will furnish both two-phase and three-phase energy, the former locally, the latter for the distribution work. It is expected that eventually the lines

will reach Troy and Albany, but for the present work is being concentrated chiefly in Cohoes, in putting upon a new basis the economy and effectiveness of the drives for the local industries. It is worth noting that here, as frequently elsewhere of late, the substations erected for the supply of energy to large consumers will be of the outdoor type. When fully equipped, the plant will contain two more large generating units and a corresponding auxiliary equipment. It represents a good example of the results that can be obtained in expanding old hydraulic developments to meet the new conditions brought about by electrical-energy transmission. There is little doubt that in a good many other instances canal systems for hydraulic distribution could be better utilized than at present by following the example set at Cohoes.

Low Receiving Antennas in Radiotelegraphy

On page 723 of this issue appears an article by Prof. Charles A. Culver and Mr. John A. Riner, describing some of their recent work on radiotelegraphy without elevated aerials. The results of the experiments which they discuss should be of great interest to radio engineers, since a number of points not generally appreciated appear to have been brought out. The entire question of low antennas, as compared with present-day aerials supported by tall structures erected and maintained at great expense, is of large economic importance.

For a number of years after the inception of telegraphy itself it was considered that the line wire connecting communicating points was an absolute essential. As distances increased the installation and upkeep costs of long lines became a more and more burdensome factor in the rapid commercial transmission of intelligence. In cable telegraphy, especially, this fixed charge has forced the adoption of high word rates in order to give the operating companies a fair return upon their investments. Radiotelegraphy has recently shown how these apparently unavoidable cost items may be eliminated or vastly reduced, but "wireless" communication has involved other construction and maintenance expenses which so far have co-operated with unfortunate engineering and commercial practices so as to indicate a lack of feasibility in the use of radio except as a substitute for long cables or in its "natural" field of ship signaling. Not the least of these handicapping costs has been that of the great aerial structures usually employed in Hertz-wave telegraphy.

In the future it is probable that radio engineers will give attention to determining proper cost balances between antenna height and transmitter power input. Similar studies applied to proposed receiving stations are also in order, and here consideration of the variation in the effects of "atmospheric" electrical disturbances with changes of aerial height is also involved. The data which the authors have secured should be useful in this connection, and it is hoped that results of many further experiments along these lines will be forthcoming as a definite help toward the attainment of cheap public telegraph service over long distances.

Effective Resistance of Steel Conductors

We know that for the delivery of continuous-current power steel has certain advantages over copper as a conducting material. The resistivity of steel is indeed much higher than that of copper and is different in different brands of steel; but, let us say, on the average it is about six times as high. On the other hand, the cost of steel is, roughly, one-tenth that of copper. On the basis of cost of conduction, steel often has therefore an advantage over copper. On the other hand, steel is more readily corroded than copper, and is much heavier and costlier to transport, install and insulate for the same conductance

When, however, we consider the use of steel for alternating-current transmission, we find that the skin effect, with its extra resistance, is much greater in steel than in copper. Large copper conductors are likely to develop a considerable extra resistance due to skin effect at sixty cycles, or even at twenty-five cycles, per second. But this skin-effect extra resistance can be reduced by dividing the conductor into fairly distant separate wires. It cannot be materially reduced by stranding the conductor. In the case of steel conductors, the skin-effect resistance may be very large, owing to the relatively large magnetic permeability of steel. Nevertheless, steel rails in the track of an alternating-current electric railway make useful conductors, even if their conductance is much reduced by skin effect. This skin effect may reduce the steel-rail conductance to less than 20 per cent of the continuous-current conductance at the same temperature; but even so, the cross-section of a track rail is relatively large, and even when virtually reduced to one-fifth, is still a very welcome addition to the return circuit.

Theoretically, the extra resistance due to skin effect in a straight round copper conductor of given dimensions and temperature, many diameters remote from its return conductor, can be computed by formulas first given by Lord Kelvin. The corresponding skin-effect extra resistance of steel conductors cannot be computed without experimental data, because it depends upon the permeability, which again depends upon the current strength; so that the extra resistance first rises, then reaches a maximum, and finally falls off, as the alternating-current strength is increased. This was first demonstrated experimentally in 1893. The skin effect is therefore different with different current strengths, and also at different radial depths in the conductor for one and the same current strength. In the case of steel rails, the effect is still further complicated by the geometrical complexity of the rail's cross-section; so that no rigid formula for the skin effect in steel rails can be hoped for. We can, at best, obtain only first-approximation formulas.

In the *Elektrotechnische Zeitschrift* have recently been published some interesting curves of experimental results on the extra resistance of certain conductors composed of particular brands of steel at different average current densities. It appears from these curves that the extra resistance of a steel conductor of given

cross-section is reduced by stranding it, perhaps on account of the increased magnetic reluctance thereby introduced into the concentric circular flux paths. The skin effect is also materially increased by laying up the strands all in the same direction of spiral. If the successive layers of wires in the strand are spiraled in opposite directions, the skin effect seems to be distinctly reduced.

It is also interesting to notice that whereas in continuous-current conductors the electrical conductivity should be as great as is commercially available—in other words, there is a premium upon high conductivity—in alternating-current conductors the electrical conductivity is not of the same importance because the skin effect increases with the conductivity. A slight diminution in conductivity may be beneficial, if it is accompanied by a considerable reduction in permeability. It is evident that the subject of economy in alternating-current conductors is more complicated than that of economy in continuous-current conductors.

A Proposed Unit of Brightness

Communications have appeared in our correspondence columns of late from several well-known photometrists dealing with the subject of brightness of luminous sources. From the standpoints of both theory and practice this is a very important subject, especially in view of the great confusion which has been produced by the lack of proper distinction between the "luminous output" and the "appearance" of surface sources, both of which have usually been expressed in candles per square centimeter. To a person unacquainted with photometry the quantitative conception of "brightness"—that is, the appearance—can perhaps most easily be conveyed by referring the light coming from a small portion of the bright surface considered at the position of the observer's eye and finding what number of candle-power at the position occupied by the area selected would produce the light received. The brightness of the source at this point of its surface would thus be expressed in "apparent candles per unit area," say, per square centimeter. Since, in general, the element of bright surface considered will not face the observer squarely, the square centimeter will have to be taken through the element but projected perpendicularly to the line of sight, so that through the imaginary square centimeter of window, placed on the bright surface and facing the observer, more than a square centimeter of actual luminous surface area would ordinarily be visualized. Unfortunately, in many cases the "brightness" thus defined is the only clew given to the luminous "output" of the source.

For many photometric purposes it is more convenient to estimate the brightness of a square centimeter of surface element as that which would be produced by a certain number of lumens of light-flux if the square centimeter of surface emitted light in all directions in accordance with Lambert's cosine law. In practice, of course, no part of a bright surface can be depended upon to diffuse its light perfectly, and the apparent lumens per square centimeter will differ materially as the observer changes his point of view and position with respect to the surface, the variation in this respect being obviously neither greater nor less than exists when the brightness is expressed in apparent candles per square centimeter. The conception and enunciation of brightness on the basis of apparent lumens per square centimeter at any point of the luminous surface, as viewed from any point of observation, are definite and often useful, although they may not be easy to convey to a tyro in photometry.

Dr. P. G. Nutting has proposed that the word "lambert" be used in referring to brightness in lumens per unit projected area. The lambert being interpreted as the equivalent in appearance to the eye of a surface source emitting 1 lumen per unit area in accordance with Lambert's cosine law, or of a perfectly diffusing, non-absorbing reflecting surface illuminated by 1 lumen per unit area, the suggestion is indeed timely and well worth serious consideration. In order to be an internationally scientific unit, the lambert should relate to the c. g. s. system, and should, therefore, be defined as an apparent international candle lumen per square centimeter of luminous surface. It is true that the lumen is not derived from the c. g. s. system, but at least its derivatives can be, and should be, referred to that system.

If an ideal perfectly diffusing and non-absorbing flat surface received an illumination of 1 lumen per square centimeter, it would possess inherently a brightness of 1 lambert. The illumination of 1 lumen per square centimeter was christened 1 "phot" by Blondel. Since there are 929 sq. cm in one square foot, a "milliphot" is only 7 per cent less than a foot-candle, and the millilambert is approximately an "apparent foot-candle." Incidentally, a brightness of 1 lambert is a convenient magnitude for practical use. The ordinary gas flame has a brightness of about 1 lambert.

A luminous surface having the "appearance" of 1 candle per square centimeter would have a brightness of 1 lambert and would have an output of π lumens per square centimeter, if perfectly diffusing—that is, emitting according to Lambert's law. Conversely, a surface having an output of 1 lumen per square centimeter would exhibit the appearance of 1 lambert of brightness when viewed from all positions if it possessed a Lambert-law emitting surface; its output would be $1 \div \pi$ candle per square centimeter. In practical work a careful distinction must always be made between the actual "output" and the "appearance," that is, between the lumens emitted per unit area and the lamberts. Whatever the nature of the diffusion, when a surface has one lambert of brightness at the observation point it has an apparent specific radiation of 1 apparent lumen per square centimeter and a brightness of $1 \div \pi$ apparent candles per square centimeter. The use of the term "lambert" would thus abbreviate and simplify the statement when brightness is expressed in terms of the apparent flux per unit area.

LETTERS TO THE EDITOR

Cheaper Wiring

To the Editor of the ELECTRICAL WORLD:

SIR:—I have noticed for some time past quite an animated discussion concerning the introduction into the National Electrical Code of rules permitting a cheaper method of wiring. So far as I am able to gather, the only argument in favor of the new wiring scheme is the increased revenues for the lighting companies. It seems rather an appropriate question to ask just how much more cheaply the Stannos or Kulo system can be installed than the cheapest system approved under the existing rules, that is, open knob or cleat work or wooden molding. Unless the saving in cost is fairly substantial it would not, in my humble opinion, justify a retrogression from our well-known standards. It appears appropriate to compare wiring costs per outlet in Europe, where labor costs are very much lower than here, with the costs per outlet in this country under existing rules and systems.

In Bulletin No. 21, issued by the National Lamp Works of the General Electric Company, compiled by Mr. S. E. Doane, chief engineer, it is shown that in Strassburg the cost is $3.80 for the first outlet down to $2.40 for the fourth in the city, and $3 in dry places and $4 in damp places, and $1.45 for switches, in the country. In Milan the cost per outlet is given as $2.

I have before me a schedule adopted by the local lighting company in which costs are estimated for wiring the house of a prospective customer and on which the contractor is paid for the work. The price per outlet for open work is $1.60 and for switches $1.70 and for concealed knob-and-tube work $2.30 per outlet and $2.50 per switch. On page 240 of the issue of the ELECTRICAL WORLD for Jan. 23, 1915, was shown a schedule which averages about $2 per outlet and $3 for drop-cords, meter loop, main switch and service.

These may possibly be isolated cases which show that the cost per outlet is cheaper in this country with existing rules and higher labor than in Europe, but I believe that they will be found to be fairly representative of the cost of this class of work, and no one can deny that in addition to being cheaper, it is in the end far safer and more satisfactory. I might also state that to my own personal knowledge concealed knob-and-tube work is being done in this city every day in residences for less than $2 per outlet.

Ever since the National Electrical Code was first distributed to the trade the tendency has been to raise rather than lower the standard of construction, and conditions found to be faulty from time to time have been overcome by new and more strict rules.

Is it, then, I ask, good policy to throw away the effect of the good work which has taken so long to build up and which has been built up successfully against much criticism, if not direct opposition, from the parties interested, to adopt something which has for its only doubtful recommendation the questionable fact of its cheapness?

In my humble opinion, as soon as this system has been approved under the National Electrical Code rules and placed on the open market every small-town electrician will use it wherever he feels disposed, as the inspector never pays even a fleeting visit. It will be installed on any kind of service available in the locality which may or may not have a grounded neutral. The most inflammable risk, the small frame dwelling cheaply constructed, will then become a much greater fire hazard than at present, to say nothing of the life hazard introduced by the installation of a bare conductor on an ungrounded system, one side of a single-phase or direct-current circuit with faulty line construction.

It might be well for those attempting to obtain the Underwriters' approval of the proposed system of wiring to give those interested some data as to the exact cost of installing the wiring per outlet with their questionably safe systems as compared with the costs stated above, which are not estimated, but actual.

New Orleans, La. W. WYNDHHAM LEWIN.

One of the Hazards in Concentric Wire

To the Editor of the ELECTRICAL WORLD:

SIR:—One of the principal claims made for concentric wiring by those advocating its early adoption is built around the excellent protection its use is said to afford both life and property, with particular reference to the former.

While it is probably true that this claim would prove true in an installation made in strict accordance with proper rules and under the careful supervision of an inspection department, it is most certainly true, on the other hand, that if improperly installed and without proper inspection, a concentric system would enormously increase the present life and property hazard, and it is the writer's desire to direct attention to the fact that a vast amount of concentric material would surely be so installed in the event of its adoption.

As is well known to everyone familiar with field conditions, a tremendous volume of wiring is being done at present without regard to the National Electrical Code, and, in many instances, in direct violation of its most important requirements. It is also well known that this condition exists in towns and cities where rigid inspection is maintained by either municipal, Underwriter or central-station authorities, or by all three, to as great an extent as, if not greater than, in localities where no inspection exists; for the bulk of this work is done by the "household scissors electrician" and is in the nature of alterations, extensions, repairs, etc., for which no successful method of forcing inspection has ever been, or, probably, ever will be, devised.

Striking testimony to the magnitude of this class of work is presented by the well-organized and well-placed retail counters which may now be found in almost any department store, large hardware store, and even in many five-cent and ten-cent stores, where short lengths of wire or lamp cord, sockets, receptacles, rosettes, fuses and the like are attractively arranged in convenient packages. This class of business has grown to such attractive proportions that many of the electrical jobbers are establishing retail stores on the prominent thoroughfares in an effort to reach the public and obtain their share of the business.

Moreover, many uninspected equipments are installed by engineers and electricians of large manufacturing and mercantile properties, by janitors and handymen in apartments and all manner of similar buildings, by the small contractor who never reports his work if it is possible to avoid doing so, and by countless other classes of mechanics who attempt to fatten their earnings by installing wiring during the evenings.

Then, too, there are hundreds of towns and villages which an inspector rarely if ever visits. It has been reliably estimated that less than 50 per cent of the United States is at present under more or less regular inspection, and a check made in several typical inspection territories has shown that only from 50 per cent

to 70 per cent of the connected sockets in a given locality have been reported for inspection at the time of installation.

The outline of "uncontrolled" conditions given above is in no sense overdrawn, nor is it based upon conjecture or theory. It is a plain statement of fact, as will be attested by any person having a knowledge of actual field conditions. That it has not been responsible for more damage to life and property is due, in the writer's opinion, to the fact that the only materials and devices thus far available have been of "approved" or "standard" type, in which a good margin of safety is provided. By this is meant that the insulation of wire, lamp cord, sockets, snap switches and the like is uniformly good enough and their construction sufficiently rugged to withstand a good deal of abuse at the hands of unskilled, inexperienced amateur electricians. Imagine what would be the result of placing concentric wire and its fittings within reach of the class responsible for this vast amount of "uncontrolled" wiring; for, if it can be manufactured and sold at as low a cost as its advocates claim, it most certainly would soon become a "leader" on the counters of the department, hardware and five-cent and ten-cent stores.

In considering this grave question the following points must be borne in mind: First, that it is not necessary to ground concentric wire to obtain results; second, that it is much cheaper and easier not to ground it; third, that, the two above points being true, it is absolutely certain that little if any of it would be grounded by persons doing "uncontrolled" wiring; fourth, that a bare, ungrounded conductor carrying 110-volt alternating current, often within easy reach, must be considered a serious menace to property and, in many instances, to life.

In fact, when viewed from this standpoint, the very real danger of adopting concentric systems for use in the United States looms to such huge proportions that we can only believe its advocates have been led to favor it through mentally applying it to more or less idealized conditions and allowing themselves to be carried away by the picture thus obtained.

Fortunately, however, the national electric committee has always studied proposed code changes from all angles, with a view to working for a consistent margin of safety on the job where inspection is either not procurable or is purposely avoided, as well as for the job under the close supervision of some inspection department. Hence the great danger of placing concentric wire and fittings within the reach of the general public will undoubtedly receive careful consideration at its hands.

Those favoring concentric wiring will probably reply to the points raised in this article by pointing to the more or less successful use of concentric wire in certain parts of Europe. This does not constitute an answer, in the writer's opinion, for, while it is true that "human nature is the same the world over," it is equally true that the average American citizen has an impatient, inborn disregard for rules or regulations which he can construe as attempted interference with the manner in which he conducts the details of his home or office that is widely at variance with the bred-in-the-bone respect accorded similar rules by most of his European brethren.

We can no more hope to legislate the danger out of concentric wiring where the average American citizen, with both his "rights" and the need of a lamp in his coal bin jointly in mind, is concerned than we can hope to import the famous German "Verboten" and expect to see it as religiously observed as it is in the realms of the Kaiser.

C. W. ABBOTT,
American Conduit Manufacturing Company.

Pittsburgh, Pa.

Concentric Wiring

To the Editor of the ELECTRICAL WORLD:

SIR:—If the new wiring plan is inherently right—by that I mean cheaper and reasonably safe—no amount of opposition will prevent its adoption. The process of introduction may be hindered somewhat and retarded, but that is all. It is my personal opinion that not even the manufacturers of the materials used in the present systems of wiring will find their business seriously interfered with, for the reason that any newer and cheaper system will find its principal applications in directions where present methods have failed. If the older methods of wiring are better and more permanent, they will still be used in buildings of the same character in which they are used to-day.

The investigations carried on for several years by Mr. S. E. Doane and his committee, and later by Mr. R. S. Hale and his committee, with the work of Mr. W. H. Blood, Jr., should settle pretty definitely the questions of safety, permanence and cost. I believe their conclusions, whatever they may be, will be accepted with great confidence by the central-station managers of the country.

R. S. ORR,
Duquesne Light Company.

Pittsburgh, Pa.

Cheap Wiring Versus Cheap Electricity

To the Editor of the ELECTRICAL WORLD:

SIR:—I note with interest what Mr. E. R. Davenport has to say in your issue dated Feb. 13 regarding cheap wiring. It seems to me that he has confused effect with the cause thereof. We hear nowadays the hue and cry of central stations that only by the introduction of cheap wiring can there be obtained an increase in the central-station load. The fact of the matter is, however, that an increase in energy-consuming devices will bring better loads to central stations than cheaper house wiring ever will.

Central-station managers always assume that the electrical contractor is charging exorbitant prices for his work, and on account of this belief many central-station managers are introducing wiring campaigns. As a matter of record, it is a well-known fact that such ventures are very expensive to central stations. After such campaigns, which prove disastrous financially, the central-station manager congratulates himself that it was worth the money to secure the extra load. The fact is that if central stations desisted from such unnecessary losses and stopped selling electrical devices "at cost"—which is at a loss, of course—the additional expenditures would bring better results if applied toward the reduction in the selling price of energy. A consumer is not interested in the cost of an appliance so much as in the cost of the energy it will consume.

The legitimate business of all central stations is the selling of energy as economically as possible. Under the guise of public benefactors they are permitted to monopolize the field of cities and territories. Any encroachment upon their territories is viewed with alarm, and justly so, for they represent a natural monopoly. However, in the majority of cases they make very little attempt to reduce their rates. It is a fact that very few central stations voluntarily reduce their rates even when they have quadrupled their output.

I believe that if the central stations will leave the contracting field as well as the selling of electrical devices strictly to legitimate contractors and devote their entire efforts toward the reduction of rates there will be less necessity for cheapening electrical work.

LEO DOLKART,
Engineer Tri-City Electric Company.

Moline, Ill.

Hydroelectric Development at Cohoes, N. Y.

Generating Station Constructed with a View to Replacing Isolated Industrial Water-Driven Installations with Electric-Motor Drive

THE hydroelectric generating station of the Cohoes Company, Cohoes, N. Y., which is now nearing completion, will have initially generating equipment rated at 27,000 kva, with provision for two similar additional units to give a total rating of 45,000 kva. The energy will be generated at 12,000 volts, three-phase, forty cycles, at which voltage and phase the main distribution will be made. However, at present a two-phase, 2300-volt system is employed in Cohoes for local lighting and industrial requirements. This energy was formerly supplied by the Cohoes Company at sixty cycles, but it will now be supplied at forty cycles.

Existing Conditions

At the time the plant now under construction was proposed the company already owned a dam and a canal system on various levels about three miles long. This canal system supplies water for driving numerous waterwheel-driven industrial plants in the city of Cohoes, the most important of these being the Harmony Mills, which use some of this water to operate turbine-driven electric generating units. In these mills is installed a 2500-kw, 600-volt, forty-cycle, three-phase steam-driven electric generating plant. When the Cohoes hydroelectric development is completed these mills will buy electrical energy from the Cohoes Company, utilizing no water from the canal. The steam-driven station, however, will be retained, as a part of the exhaust steam is utilized in manufacturing processes and for heating.

The Cohoes Company at this time has two small hydroelectric generating stations. The one on the present canal system will be held in reserve, while the other, which is now supplying sixty-cycle energy, will be changed to forty cycles. The latter is not supplied from the canal system previously mentioned, but is situated some distance further down the river and has an independent dam.

The new power station is a few hundred feet below a natural fall in the Mohawk River, about 3000 ft. above which is the old dam of the Cohoes Company with its crest at an elevation of 155.7 ft. above tidewater. The low-water-level elevation at the power house is 58.0 ft., thus giving a fall of 97.7 ft. The high-level canal of the company is fed from the Mohawk River at this dam and extends about 2000 ft. into the mill district beyond the forebay of the new plant.

Three 20-ft. by 22-ft. electrically operated penstock gates without counterweights are installed in the forebay gatehouse, with space for two additional gates. In front of the gates are screens of 3½-in. by 5 1/16-in. rack bars spaced 3 in. between centers and supported on an I-beam frame. An ice spillway is provided at one side of the forebay, where three manually operated, downwardly moving gates are installed to pass ice, the gates having a maximum range of movement of 10 ft.

The penstock gates are each operated by a 220-volt, 25-hp induction motor, the control boards for which are in the brick gatehouse. Push-buttons are installed on these boards for the normal operation of the gates, but control wires are also carried to the main switchboard in the station for emergency use.

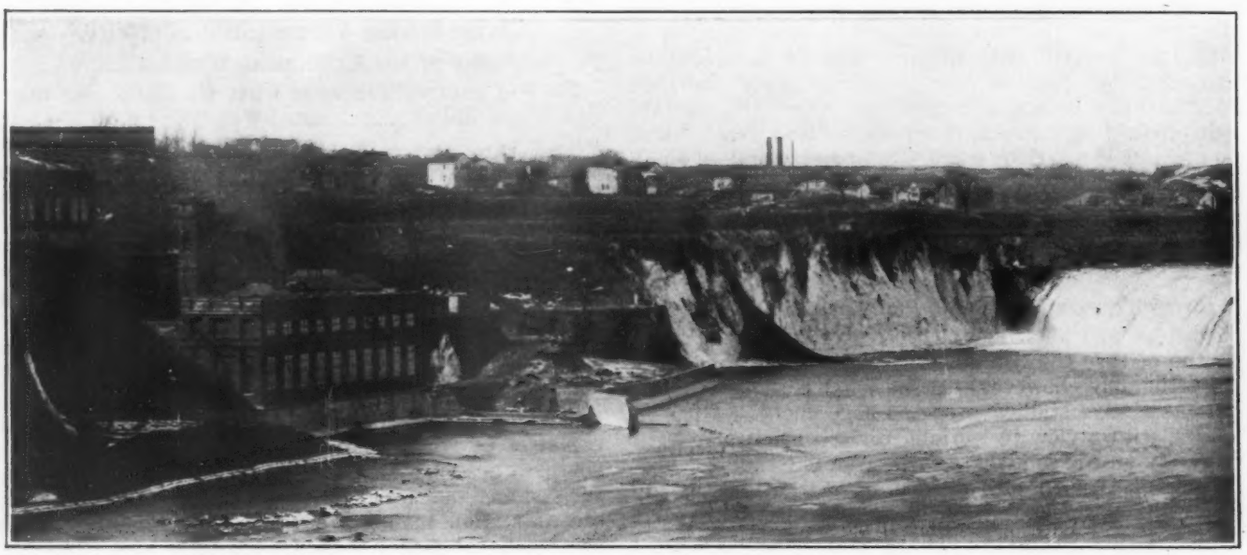


FIG. 1—EXTERIOR VIEW OF POWER PLANT

Three penstocks, each 11 ft. in diameter and 200 ft. long and each supplying one wheel, are at present installed, together with such portions of two additional penstocks as are embedded in the concrete substructure of the gate and power house. Heavy rods embedded in rock and concrete anchor the penstocks near their upper elbows, in addition to which frequent concrete saddles are provided. The saddles at the lower elbows are merged into a continuous support.

Water Turbines

Three 10,000-hp vertical-shaft, single-runner Francis wheels with cast-iron scroll cases and made by the Platt Iron Works, Dayton, Ohio, are installed, the centers of the wheels being at an elevation of 69 ft., or 86.7 ft. below the level of the water in the forebay and 11.0 ft. above low-water level. These wheels are mounted below the station floor as shown in Fig. 2. A 60,000-ft.-lb.

Ontario-type Lombard governor regulates each wheel, remote electric control being provided. Space is provided in the present building for two additional wheels.

Station Construction and Layout

The accompanying illustrations show the general design of the station, which is of brick, steel and concrete construction. It consists of a main operating room, 40 ft. by 165 ft. and 39 ft. high, and a two-story switch house 25 ft. by 165 ft. and 24.5 ft. in height. The spacing of the building columns in the lower section of the switch house divides its length into ten bays of equal length. The basement floor of the switch house between penstocks is 15 ft. below the main floor, which is 22 ft. above low-water level. This main floor is of reinforced concrete supported by concrete columns. The upper floor level is 13 ft. above the main-floor level for the five downstream bays and 15 1/3 ft. above the same level for the other five bays. Both portions are of concrete supported on steel beams, the upstream portion having two intermediate supporting columns because of its heavy load. A tower containing a stairway and elevator permits access to the power house from the gatehouse by means of a bridge.

Large windows are provided on all four sides of the station, making the natural illumination very satisfactory. Incandescent lamps are used for artificial lighting, nine 400-watt gas-filled lamps being provided for the operating room. The station is steam-heated from a small exterior steam plant.

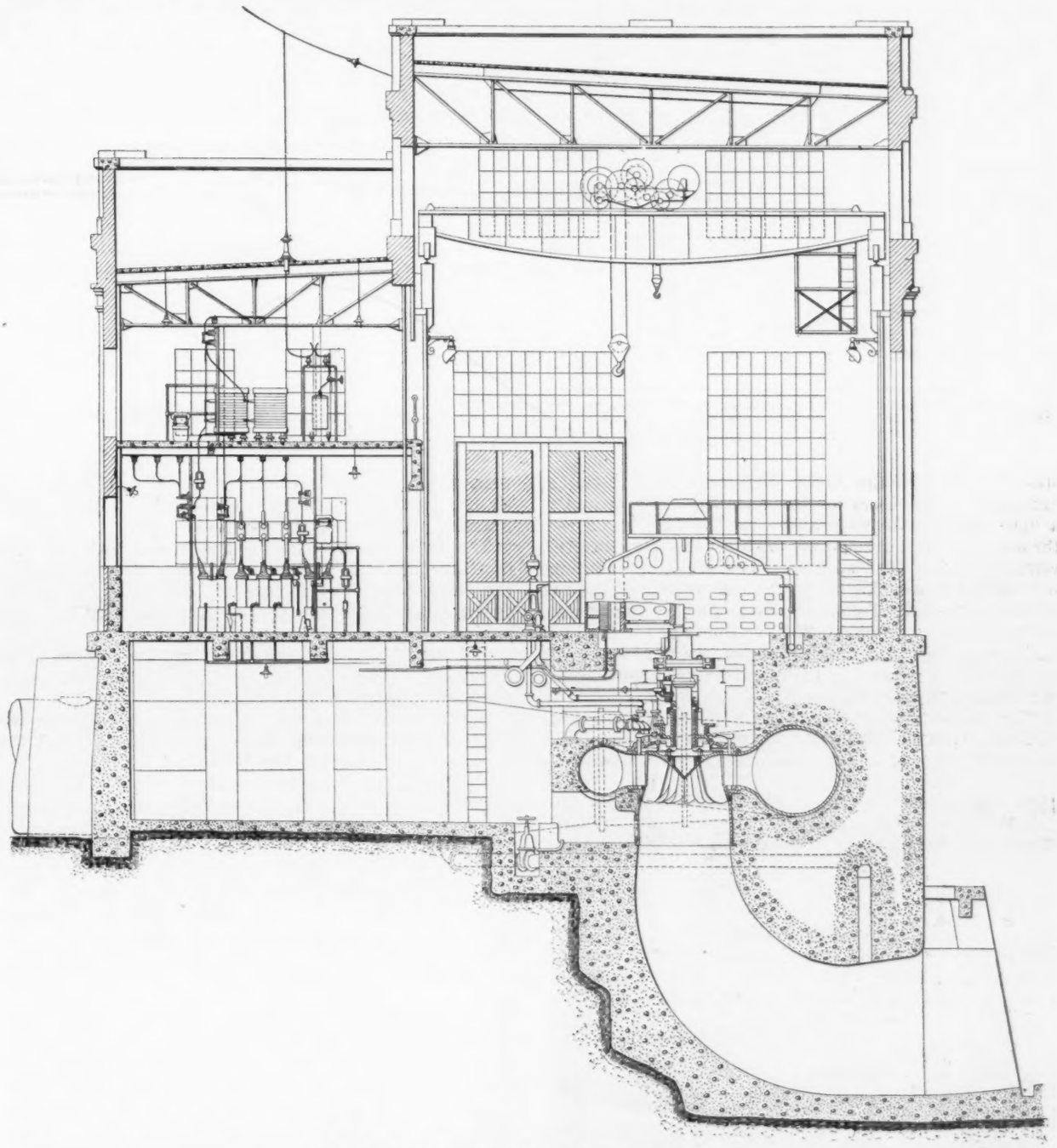


FIG. 2—CROSS-SECTIONAL VIEW OF POWER PLANT

Layout of Apparatus

Odd-numbered bays in the basement of the power house are occupied by the penstocks. The second bay

from the downstream end contains the oil tank for the governor oil pumps and the two 50-kw, 2300/220-110-volt station-lighting and power transformers. The fourth bay contains an elevator hoist and a rheostat room for the resistance grids of the main generator field rheostats. The rheostat grids are mounted on

The first bay on the main floor of the switch house is divided by partitions into two rooms, one of which is used as a washroom while the other contains a 10-amp-hr. storage battery for oil-switch and governor-motor operation and emergency lighting. The next bay contains two induction-motor-driven governor oil pumps

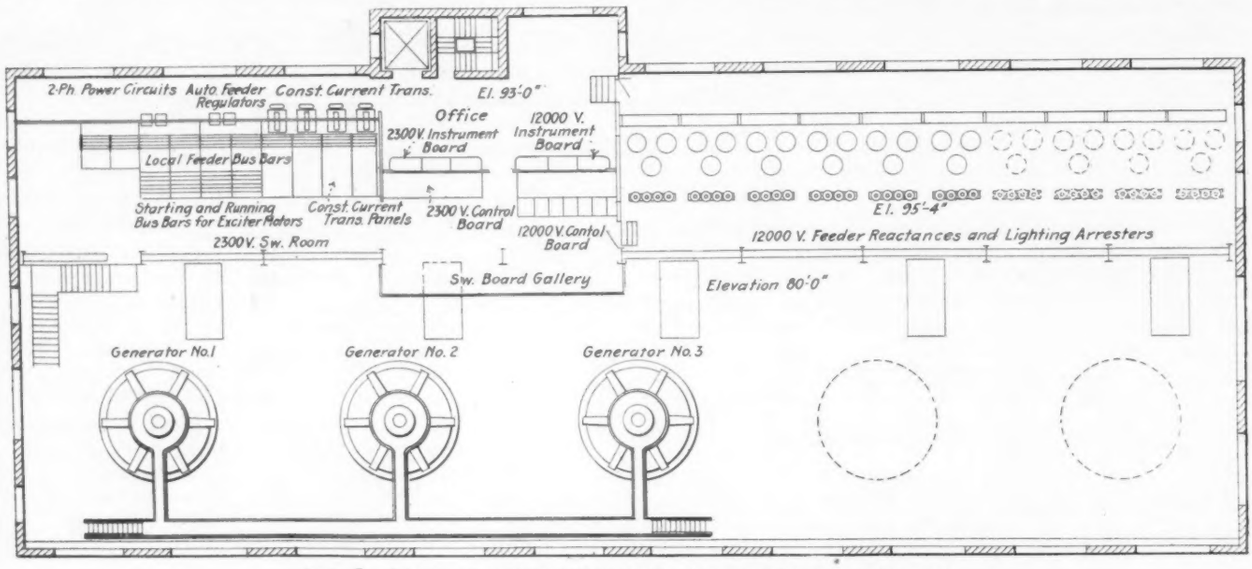


FIG. 3—PLAN OF GENERATOR ROOM AND SWITCHING GALLERY

steel beams set in the floor. Several cool-air inlets are provided in this room at the floor line. By means of a hot-air flue extending above the elevator-tower roof through the wall formed by the stairway very effective ventilation has been secured. The sixth bay contains six reactance coils for the high-tension sides of the two 800-kw step-down T-connected transformer banks used for furnishing two-phase, 2300-volt energy for local use and also a filter tank with oil pumps for the lubricating system. The remaining bays will be used temporarily for storage purposes.

The main floor of the station contains the three General Electric 9000-kva, 12,000-volt, three-phase, forty-cycle vertical-shaft generators, each of which is

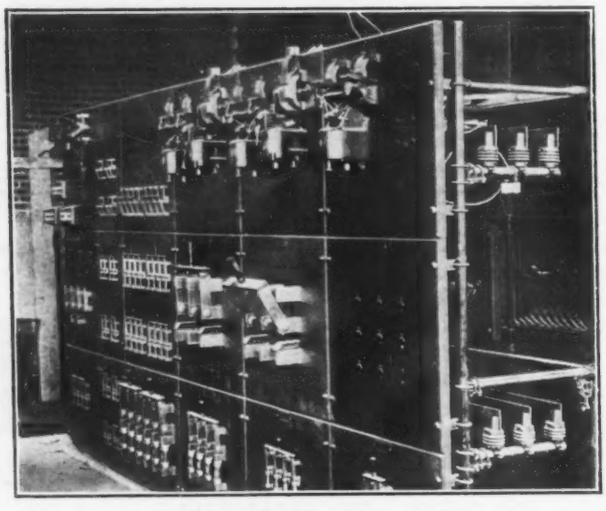


FIG. 4—VIEW OF EXCITER BOARD

directly connected to one of the turbines previously described. These generators run at a speed of 185 r.p.m. and are equipped with Kingsbury bearings, the weight of the revolving element of each generator being approximately 50 tons.

with starting compensators mounted opposite each pump on the partition between the second and third bays. Space is provided for one additional unit.

The two General Electric motor-generator sets for exciting the fields of the alternators are installed in the third bay. The motors of these sets are of the squirrel-cage induction type, operating at 2300 volts and having a rating of 250 hp. The generators are compound-wound, and each is rated at 165 kw and 250 volts. Provision is made for the installation of an additional motor-generator set, when required.

In the fourth bay the switchboard panels for the exciters, station-lighting and power circuits and the storage-battery circuits are installed. A 3.5-kw, 110-volt induction-motor-driven battery booster is placed near the latter panel. On the exciter panels are mounted the electrically operated switches for the main generator field circuits, which are controlled from the main board on the floor above. On the rear of this switchboard are the motor-operated rheostat dials, which are also controlled from the main board. These dials are connected by leads to the corresponding resistance grids in the basement. A passageway from the elevator and stairway tower to the generator room is provided in this bay.

The fifth bay is extended so that its outside wall comes in line with the rear wall of the elevator tower. This addition permits the placing of two 800-kw step-down transformer banks for Cohoes two-phase, 2300-volt service and two three-phase, 12,000-volt oil switches electrically operated from the main control board. The necessary knife disconnecting switches are mounted on structural-steel framing. Each switch unit is mounted on a concrete base 24 in. in height and inclosed by a screened protective railing 6 ft. in height.

The next three bays contain the 12,000-volt busbars of copper tubing mounted on porcelain insulators supported from the floor beams above, the generator, feeder and bus-sectionalizing oil switches with their disconnecting switches, and current and potential transformers. The oil switches are mounted as in the fifth bay, while the disconnecting switches and series and shunt

instrument transformers are carried on structural-steel supports attached to the intermediate columns. A very compact arrangement of apparatus with ample passageways is obtained by arranging the generator and feeder oil switches in two parallel rows, one generator switch and two feeder switches being installed in each bay.

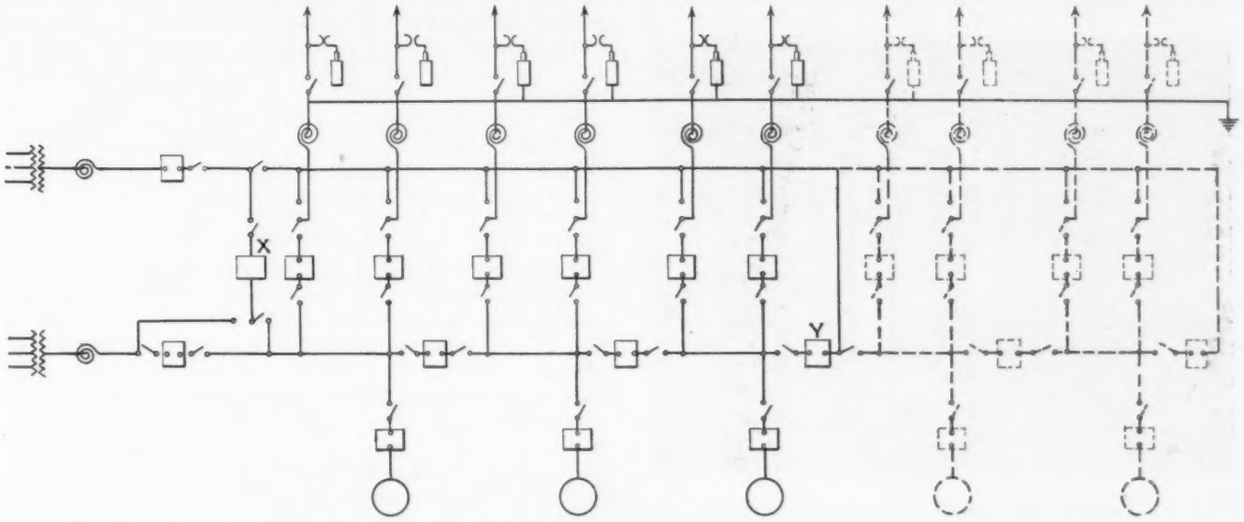


FIG. 5—RING-BUS SYSTEM

The bus-sectionalizing oil switches dividing the busbars in adjacent bays are placed between the two rows of generator and feeder switches and at right angles to them. By this arrangement every window in this section is unobstructed and all apparatus is readily accessible for inspection.

The first three bays of the second floor of the switch house contain apparatus for the 2300-volt two-phase circuits serving the present system of Cohoes. Two two-phase motor circuits and four single-phase house-lighting circuits with automatic-feeder regulators are at present installed, together with four seventy-five-lamp constant-current transformers for the series street-lighting system. These bays also contain the oil switches for the low-tension side of the 800-kw transformer banks, starting and running switches for the exciter units, and switches for controlling the high-tension sides of the station transformers.

The next two bays contain respectively the 2300-volt control board and the main benchboard. These bays are also partitioned off from the rest of the switch house. These partitions, together with a third partition 4 ft. to the rear of the switchboards, form a room used for office purposes, a suspended ceiling being hung from the bottom chords of the roof trusses.

Forming a part of the office wall behind the 12,000-volt and 2300-volt switchboards are two auxiliary switchboards with panels corresponding to those on the main board and carrying recording meters and testing plugs for the various circuits controlled from the main panels. These auxiliary switchboards are also provided with horizontal table sections for meter-testing purposes.

The next three bays are at a higher level, as previously mentioned, and contain protective reactances and electrolytic lightning arresters for the two 12,000-volt feeder circuits in each bay. These reactances are of the white-enameled, brick-finish type and were supplied by the Metropolitan Engineering Company of Brooklyn.

The 12,000-volt benchboard has seven sections, two of which are for future use. It is of the usual slate construction, with dummy buses and indicating lamps. On this board are mounted the control switches for the generators, for the high-voltage outgoing feeders and for the high-voltage sides of the two 800-kw T-connected transformer banks for stepping down the 12,000-volt, three-phase energy to 2300-volt, two-phase energy for local requirements, as well as synchronizing devices, governor-speed and head-gate control switches, generator field-rheostat controllers and the necessary indicating instruments.

By means of an additional set of busbars running parallel with the others, as shown in Fig. 5, and connected to the first and last bus-section switches, a sectionalized ring-bus system has been obtained. Any feeder the switch of which is temporarily out of service can be thrown on this additional set of busbars by

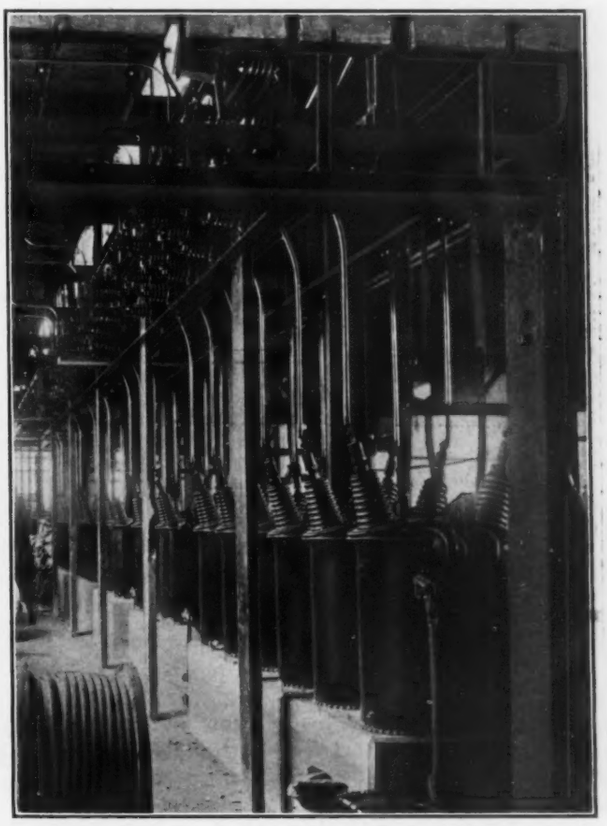


FIG. 6—HIGH-VOLTAGE OIL-SWITCH ARRANGEMENT

means of a double-throw disconnecting switch, as shown, and can be controlled from the last bus-section switch. Of the two 800-kw, 12,000/2300-volt transformer banks, one is connected only to the additional set of busbars, while the other by a similar double-throw disconnecting switch can be connected to either side of the ring bus. The main generator oil switches and the corresponding

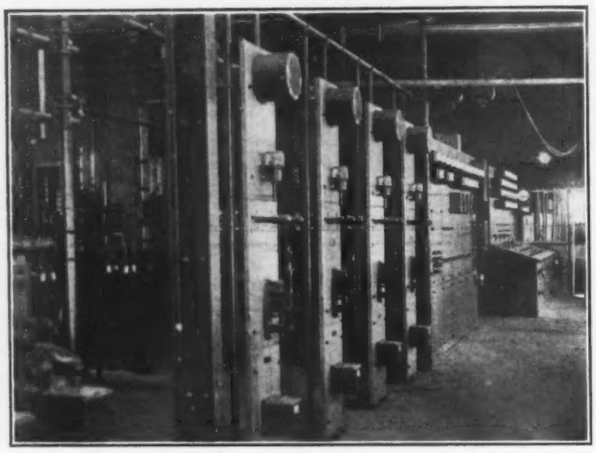


FIG. 7—BENCHBOARD AND MAIN SWITCHBOARD

field switches are electrically interlocked, making it impossible to open a field switch while the corresponding generator switch is closed.

The 2300-Volt Switchboard

The 2300-volt, two-phase switchboard is provided for the control of the low-tension sides of the 800-kw transformer banks with their subsidiary circuits. These circuits include a double tie between the exciter-motor busbars, which are fed directly from the 800-kw transformer banks, and the busbars for the Cohoes local power and lighting circuits, exciter-motor starting and running circuits, Cohoes power and house-lighting circuits, and the high-tension side of the station

FIG. 8—FEEDER REACTORS AND LIGHTNING ARRESTERS

power and lighting transformer bank. A Tirrill regulator panel has been included in this board. All oil switches for the circuit connections are electrically controlled from this board, and the necessary indicating meters and synchronizing devices have been provided. The switchboard does not carry recording instruments and relays for the circuits controlled by it, these instruments being mounted on a separate switchboard forming part of the office partition wall, as in the case of the 12,000-volt board. The panels for the series street-lighting circuits are not included in this board but are mounted in front of their respective constant-current transformers. These panels are provided with hand-operated, remote-control oil switches. All outgoing lines of the system are provided with oil switches, lightning arresters, choke coils and disconnecting switches.

The 110-volt energy for the control system is normally obtained from a small motor-generator set. A storage battery is employed for furnishing the necessary energy in case of failure of power.

Distribution

Six high-tension outgoing lines are dead-ended at the building by means of bolts and suitable insulators, the lines leaving the station through the roof, as shown in Fig. 2. Two wood-pole lines will serve initially one 6000-kva and seven 750-kva outdoor substations in Cohoes and vicinity, the voltage being transformed to 600 for serving various mills. Ultimate extensions will reach Troy and Albany. The low-tension outgoing lines comprise two two-phase, four-wire motor circuits, four single-phase house-lighting circuits and two street-lighting circuits, all of which are tapped into the present distribution system.

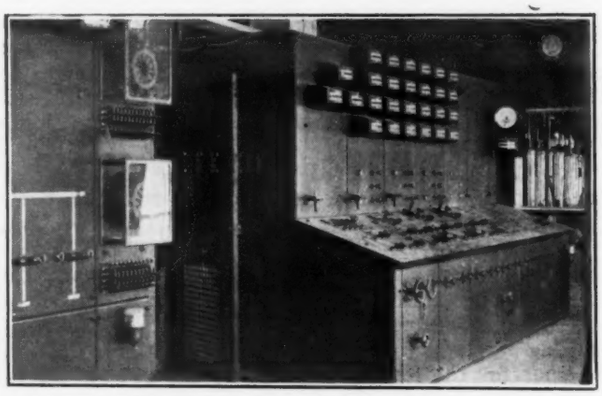


FIG. 9—VIEW OF SWITCHBOARD

The complete installation is being made by the Cohoes Company, of which Mr. L. Semple is president, Mr. W. P. Parsons manager, and Mr. A. C. Polk construction superintendent and resident engineer. Sanderson & Porter, New York City, are the designing and supervising engineers, and Mr. Thomas E. Murray, New York City, is the consulting engineer.

Detroit's Three "Attendantless" Rotary Substations

Three "attendantless" rotary-converter substations, in general similar to the initial Rowena Street station described in the ELECTRICAL WORLD of June 28, 1913, are now served from the lines of the Edison Electric Illuminating Company of Detroit. The latest of these unusual equipments, which are started, synchronized, thrown onto the system and controlled from a distant operating switchboard, has been installed in the basement of the new Statler Hotel on Detroit's Grand Circuit Park. This newest substation is being equipped with a mechanical tripping device which will operate the breakers even in the absence of voltage on the local operating bus.

Radiotelegraphy Without Elevated Antennas

Experiments with Low Horizontal Aerials—Successful Results Attained with Use of Single and Multiple Earth-Wire Systems

BY CHARLES A. CULVER AND JOHN A. RINER

THE present notes describe extensions of tests mentioned in an earlier paper[1] on experiments with low horizontal aerials. In addition to a telephone line 250 m in length and 3 m high, referred to in the previous paper, there was established a second low horizontal system consisting of a single wire of approximately the same length and height, but extending in a southeasterly direction (instead of toward the south). On the night of Nov. 17, 1913, a heavy mist prevailed at Beloit, and all outdoor objects were thoroughly wet. Owing to poor insulation, the above line was grounded at one point at least, and probably at other points, but even under these unfavorable conditions signals from Atlantic coast and other stations were heard strongly when this line was used in place of the ordinary aerial.

At 7:26 on the evening of Nov. 23 the Arlington station was heard sending longitude signals to Paris, using either the telephone line or the special low horizontal antenna. The weather was fair and cool.

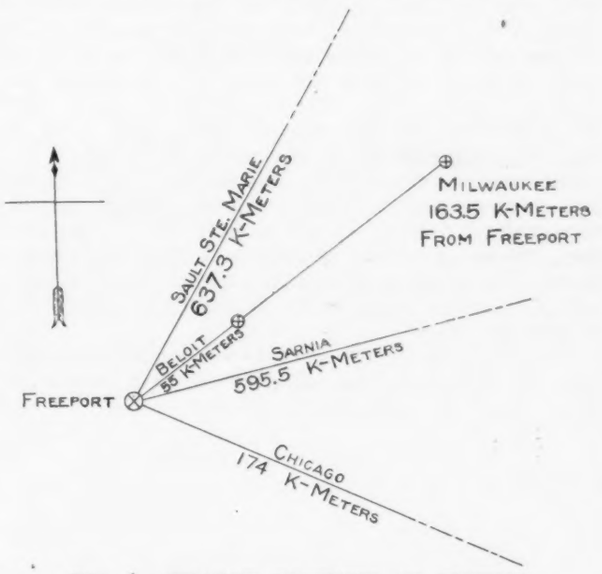


FIG. 1—RELATIVE POSITIONS OF STATIONS

Similarly, Arlington and Key West were heard loudly at Beloit on the night of Dec. 8, the weather being clear and cold. At 11:45 p.m. Jan. 28, 1914, while rain was falling, a coast station was heard on the special horizontal system as plainly as when employing the large aerial of the Beloit station. On the same date the experiment was also tried of utilizing the horizontal system as a "ground" in connection with the large aerial. This combination likewise gave strong signals.

As a result of the above preliminary tests with low antennas and of those reported in previous papers, it was decided to carry out further experiments of a similar character over distances comparable to those occurring in radiotelegraph practice. Accordingly a series of tests were conducted between Beloit, Wis., and a temporary field station at Freeport, Ill., the distance covered being approximately 34 miles (54.7 km).

[1] *Physical Review*, N. S., Vol. III, No. 4, April, 1914.

The antenna of the Beloit College station is of the L type, and consists of a four-wire horizontal portion some 90 m long, with a slanting two-wire section about 30 m in length. The horizontal section makes an angle of 45 deg. with the meridian, the free end extending to the southeast. Energy is delivered to this system by a 1-kw transformer operating through a rotary non-synchronous gap and loosely coupled oscillation transformer. Signals of fairly constant intensity were automatically sent out by the Beloit station on a 900-m wave-length, and received by the field station near the city of Freeport. The logarithmic decrement of the Beloit station when using the above wave is approximately 0.16.

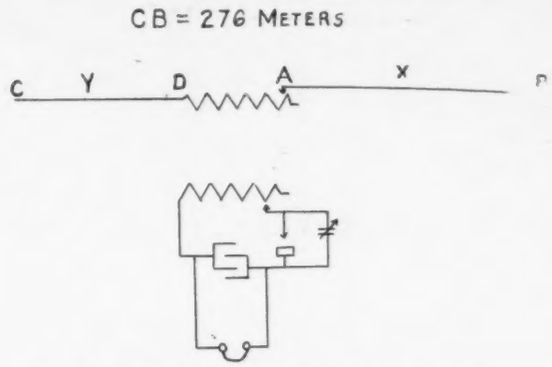


FIG. 2—RECEIVING SYSTEM AT FIELD STATION

The field station at Freeport employed the usual loosely coupled receiving transformer with crystal detector and telephone receivers. As no facilities for quantitative measurements were available at the time, the tests about to be described were purely qualitative in character. The relative positions of the several stations involved in the experiments are shown in Fig. 1.

The first tests of the new series were made on July 10, 1914, the receiving station being established in a field on a bluff about 60 ft. above a creek. The thin soil with limestone subsoil was covered with grass, and the weather was hot and dry. The receiving system *CD-AB*, shown in Fig. 2, consisted of a single No. 18 double-cotton-covered wire, 274 m in length, unwound from the secondary of an old transformer, but so badly burned that only about half the insulation remained. During the succeeding experiments the wire became entirely bare. Referring to Fig. 2, half of the wire *CD* rested directly upon the ground, while, by means of linen thread, *AB* was suspended from the lower branches of trees at a height of

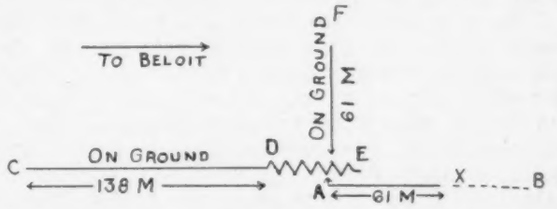


FIG. 3—SECOND ARRANGEMENT OF WIRES AT FIELD STATION

about 7 ft. above the earth's surface. With this arrangement the time signals (3 p. m.) and other signals from the Beloit station were plainly heard on several different days. On July 14 one-fourth of *AB* (which previously had been entirely clear of the ground) was allowed to rest upon the grass and it was found that the signals were still readable. When three-

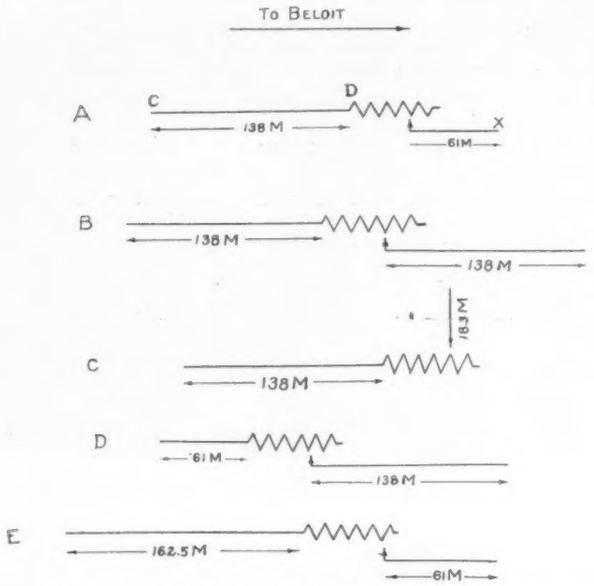


FIG. 4—TESTS TO DETERMINE OPTIMUM LENGTH

fourths of *AB* rested on the ground signals were diminished in intensity. With *AB* entirely on the ground no signals could be heard. With *AB* shortened by approximately 77 m and the free end lying on the ground the loud signals which resulted seemed even stronger than when *AB* was entirely supported.

On July 15 a test was made with the 61-m wire *AX* (*AB* having been cut approximately in half) entirely on the ground, and signals from Beloit were heard very strongly. Beloit could not be heard at all, however, when we removed one-half of *CD*, leaving *YD* and using either *AX* or *AB* in connection with it.

From this point all tests were conducted with the wires at the receiving station on the ground. A wire was placed upon the grass at right angles to *CX* and 61 m in length, as shown in Fig. 3. The combination *EF-AB* gave no signals. The system composed of *CD* and *EF* gave strong signals. Upon connecting *EF* and *AX* in multiple and using *CD* as the other half of the system, no very marked effect upon the signals was noted, and no change was observed when *EF* was swung around parallel to *AX*. Using the system *CD-AX*, the wire nearer to Beloit (*AX*) was pulled back toward *A*, so as to form a zigzag arrangement. With this condition readable signals were received. On July 16 a slight rain fell at noon, yet at 3 p.m., with the system *CD-AX* lying *in the wet grass*, the Beloit clock signals were heard. Messages could not be read, however, because of heavy static.

On July 17 an attempt was made to determine the optimum length of wire to be employed when receiving this 900-m wave-length. The various arrangements shown in Fig. 4 were tested, with all wires lying on the ground, and it was found that system A gave the best signals. B and D gave very faint indications, C was fair, and E was good but not so strong as A. The resonance curve was quite flat when employing these systems. On subsequent dates this series of tests was continued by varying the length of *CD* by looping the free end *C* back toward *D*. As *C* approached *D* the signals decreased in intensity, and they became nearly inaudible when *C* reached *D*. In contrast with this result, the effect upon the strength of the signals when the end *X* was doubled back to *A* was much less marked. The swinging of *AX* through a wide angle resulted in a slight diminution of the signals. A comparison was made between the efficiency of system A when the wire *CD* was resting on the wet ground in a field of stubble and when it was insulated from the ground on stakes about 1 ft. high. No difference could be detected. The behavior of system A on receiving 600-m wave-length was shown on July 18, when Chicago (call letters "G O") and Milwaukee ("W M E") were distinctly heard. Upon shortening the wire pointing toward Beloit to 30 m the strength of the signals from the above commercial stations was decidedly increased.

Beginning July 28, 1914, the tests were carried out in the evening between 7 and 7:30, on account of the heat and high winds during the afternoon. It was found that by substituting for *CD* a connection in the running water of a creek no appreciable improvement was made in either sharpness of tuning or loudness of signals. The natural period of the system was, however, modified by this change, as appeared from the fact that increased capacity was needed in the secondary circuit.

Tests were next made to determine the directive effect of the longer wire *CD*. Fig. 5 shows the conditions for the four arrangements tested. The 61-m wire was not altered during the experiments, but the 131-m wire was swung through approximately 135 deg., and signals from Beloit were observed at each of four positions. Referring to Fig. 5, signals received on system *A-E* were good, those on *B-E* fair and those on *C-E* strong. *D-E* gave no signals at all. The combination *C-E*, in which the long wire extended almost directly away from Beloit, was decidedly the most efficient.

On August 4 the weather was clear and dry. A test was made to determine the minimum power necessary to signal from Beloit to the receiving station at Freeport, the latter employing system A (Fig. 4). It was found that commercially readable signals could be transmitted when the input at the transmitting station was reduced to ¼ kw.

The next series of experiments was made for the purpose of determining the effectiveness of a simple system, such as A in Fig. 4, as compared to that of a mul-

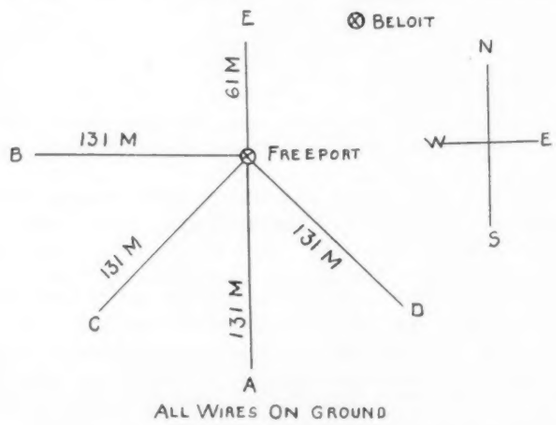


FIG. 5—TESTS OF DIRECTIVE EFFECT

tiple-wire arrangement. The results of this group of tests appear to the authors to be of considerable practical and theoretical importance. Figs. 6 and 7 show the arrangements of wire used in these experiments. The single-wire system A (Fig. 6) was used as a standard for the comparison of signal intensities. It was found that adding a second wire to the left-hand part (B, Fig.

6) caused an increase of signal strength, and that connecting the ends of the two long wires together (C) gave a slight further improvement. The addition of a third wire, giving arrangement D, increased the intensity considerably beyond that secured on B. On E no signals were heard, and F gave only weak signals.

The result of adding a second wire to the right-hand part of system D (Fig. 6), and so forming the arrangement G (Fig. 7), was most marked in several respects. In the first place, the intensity of the signals was greatly augmented, and the commercial stations "W M E" and "G O" were heard strongly. In fact, the intensity of these signals appeared to be as great as when the large elevated aerial at Beloit was used. System J (Fig. 7) gave even better results than G, for with it many commercial stations, including Sault Ste. Marie, "V B B," and Sarnia, "V B E," were easily read. The Sarnia station was especially loud, although nearly 600 km away. A second advantage of systems G and J over the others tried (as, for example, A, Fig. 6) is that the tuning was found to be as sharp as that which obtains when employing elevated aerials of the commercial types. System H does not differ materially in effectiveness from G. System I gives fair results, in marked contrast to the results with E, Fig. 6.

In this general connection it is interesting to note

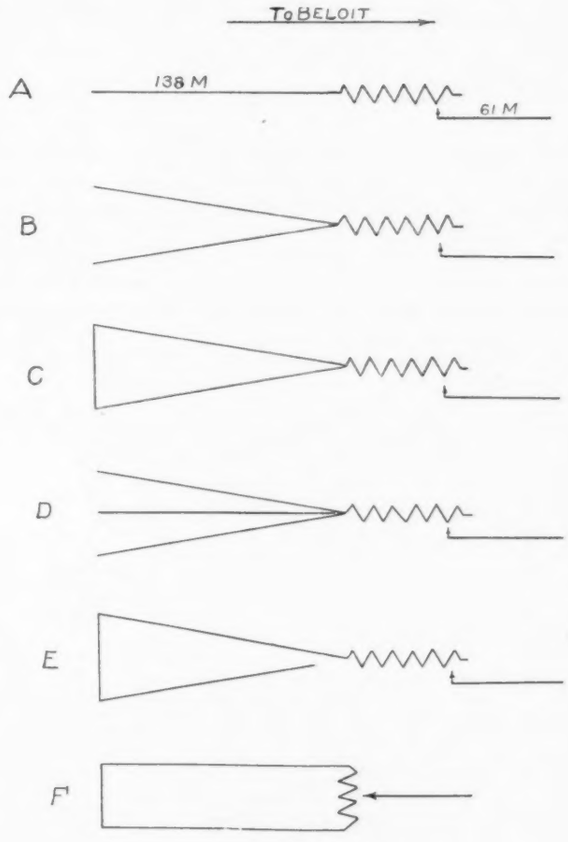


FIG. 6—MULTIPLE-WIRE ARRANGEMENTS

that if one of the two right-hand wires in G (Fig. 7) is added in series with the other, thus forming one wire of double the original length, the efficiency of the resulting system is comparatively low. Further, upon shortening the right-hand wire of G (Fig. 7) by as much as one-half, the effectiveness was decreased; small changes produced no noticeable effect.

Notwithstanding the fact that bare wire was used in these tests, when the outer ends of the wires in our several arrangements were deliberately connected to earth the system would not respond to the incident radiation. If, however, the wires were directly connected to earth near the receiving instruments, no appreciable effect was produced upon the intensity of the

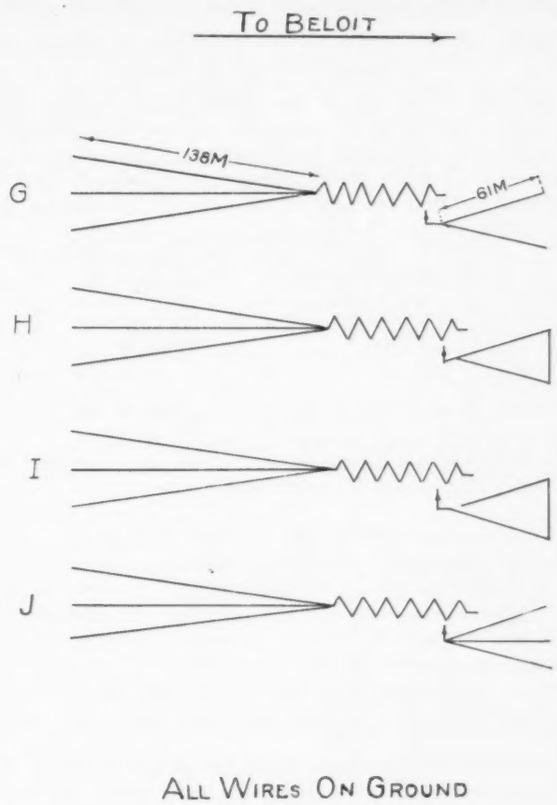


FIG. 7—MULTIPLE-WIRE ARRANGEMENTS

signals. In this connection it should be mentioned that during the greater part of August the surface of the soil was dry.

As a result of the experiments several facts stand out more or less clearly. In the first place, so far as we know, this is the first time in this country that electric waves have been successfully received over commercial distances by using a single bare wire placed directly on the ground. Further, it is apparent that a somewhat symmetrical multiple earth-wire system may be used for receiving in practical radio communication, without necessitating any increase in sending power over that employed when utilizing ordinary elevated antennas. It is also evident that such single or multiple earth-wire systems possess a directive effect, and that the elements which extend away from the transmitting station are the most important in this respect.

It would appear that such a system operates most effectively when its electrical length, including the winding on the transformer primary, is something like one-fourth that of the incident wave. The receiving instruments, it seems, should be inserted about one-third the distance from the end nearest the transmitting station, and to operate at the same efficiency the total length of such a ground-wire system should be approximately twice that of an elevated aerial. When used as an absorber, insulation of the wires apparently plays a very minor part. The ease and dispatch with which an earth-wire system may be installed makes the plan valuable for use under certain conditions, particularly in military operations and press work.

It remains to be determined whether a similar arrangement may be used over commercial distances as a radiating system, and many of the properties of such earth wires are still to be worked out quantitatively. The authors are continuing their experiments along both these lines.

BETTER BUSINESS IN GENERATING FIELD

Percentages of Increase in Gross Income and Output Tend to Return to Pre-War Rates

Returns received by the ELECTRICAL WORLD from central stations show gains in income from sales of energy and in kilowatt-hour output in December, 1914, as compared with December, 1913. Throughout 1914 the public utility companies were at a disadvantage. The

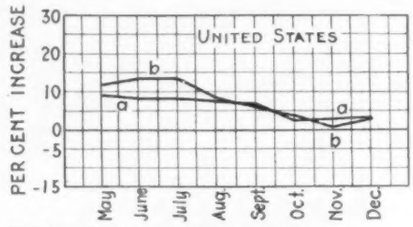


FIG. 1—PERCENTAGE-GROWTH CURVES FOR THE ENTIRE COUNTRY

uncertainty over the business situation in the first seven months made many commercial and manufacturing organizations timorous, and they curtailed their activities. The shock of the war and the influences resulting from that cause followed. Although electric central stations suffered much less than electric railways from the decline in public consumption, their sales of energy to railways were decreased by the reduction in the use of transportation facilities.

Central stations would have fared much worse had the character of their business been less diversified. Nothing short of widespread depression can materially lower the percentage rate of growth of generating companies. The only effect of the business depression in the first part of 1914 was to hold the rate of growth constant, when otherwise it might have gone much higher. New ventures of large importance were abandoned or their completion deferred till better conditions should prevail. The natural growth of existing business kept up. For these reasons the companies found the conditions of growth normal.

In the light of later developments the early 1914 depression in some ways was an advantage to utilities. Had the companies experienced a phenomenal growth early in the year, many would have been obliged to expend large sums of money in enlargements and extensions. Under the condition existing in the money market late in 1914 such measures would have been difficult to finance, as the interest charges would have affected the income which would otherwise have been available for dividends.

TABLE I—CENTRAL-STATION RETURNS FOR SEVEN-MONTH PERIOD

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (45 per cent of industry)	$14,295,321	$13,099,007	9.1	674,877,591	602,832,337	12.0
June (45 per cent of industry)	14,073,840	12,996,198	8.3	682,791,096	603,122,008	13.3
July (50 per cent of industry)	14,086,822	12,970,325	8.5	735,937,850	649,720,026	13.3
August (51 per cent of industry)	15,298,226	14,200,649	7.8	778,109,565	718,274,456	8.2
September (51 per cent of industry)	15,708,695	14,694,205	7.0	782,450,267	733,754,420	6.8
October (59 per cent of industry	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.7
November (65 per cent of industry)	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
December '65 per cent of industry)	21,296,659	20,605,452	3.4	1,084,969,908	1,056,668,763	2.9

In the accompanying tables are recorded income and output totals for corresponding months in 1914 and 1913, together with the respective percentage growths.

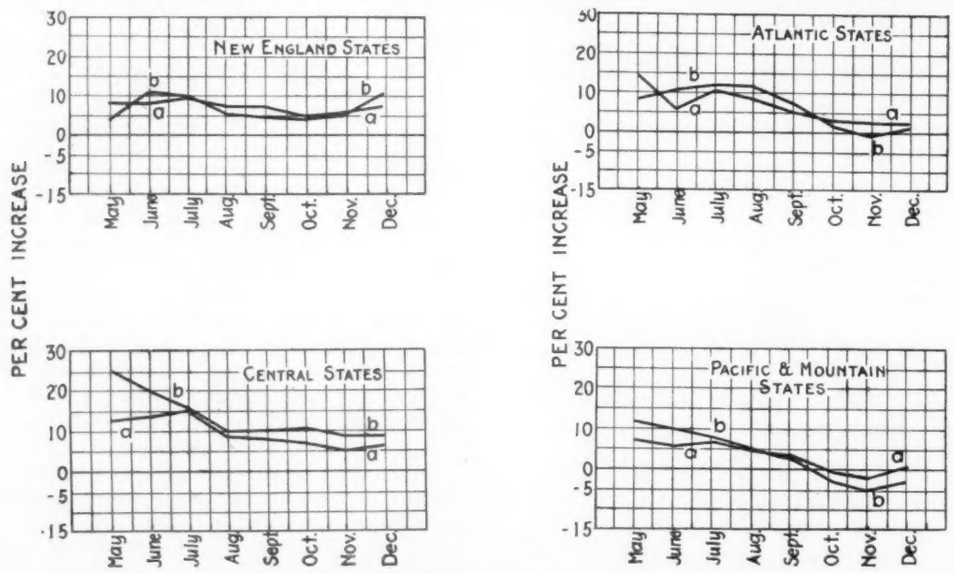


FIG. 2—PERCENTAGE-GROWTH CURVES FOR GROUPS OF STATES

The percentages of the industry stated in the tables represent the approximate percentages of kilowatt rating of installed generating equipment. From the October, 1914, lighting and power edition of the "McGraw Electrical Directory" the aggregate kilowatt rating of installed generating equipment of each state was ascertained. The total rating for companies reporting to

the ELECTRICAL WORLD was calculated. From these data the percentages of the industry represented in the returns were calculated. Thus companies in the Pacific and Mountain States whose aggregate rating of generating equipment amounted to 88 per cent of that for the entire region forwarded to the ELECTRICAL WORLD the operating statistics included in the December totals.

The accompanying curves show graphically the changes that have taken place in the percentage rate of growth in both the gross income and the energy output. Curve *a* represents income and curve *b* output. The figures of Table I are regarded as typical for the whole country, and from them it is simple to derive totals for 100 per cent. If, for instance, 65 per cent of the industry shows certain changes, the assumption in the calculation is that the remaining 35 per cent would have shown the same changes. During the five months ended Dec. 31, 1914, the gross income of the central stations of this country was $154,000,000 as compared with $147,400,000 for the last five months of the previous year. This is a gain of $6,600,000, or 4.6 per cent. If the July, 1914, returns are included, the 1914 total becomes $182,000,000, against $173,400,000 for the last half of 1913, an increase of $8,800,000, or 5 per cent. Roughly apportioned among the estimated population of 100,000,000, this would mean that during the last half of 1914 an average of 8.8 cents more was spent per inhabitant for electrical energy than during the corresponding period of 1913. On a monthly basis this would mean 1.47 cents per month more per person in 1914 than in the previous year.

TABLE II—CENTRAL-STATION OPERATIONS FOR THE NEW ENGLAND STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (55 per cent of industry)	$1,745,160	$1,609,234	8.4	52,752,247	50,779,103	3.9
June (58 per cent of industry)	1,560,872	1,442,178	8.3	53,463,013	48,049,756	11.1
July (60 per cent of industry)	1,670,819	1,530,410	9.2	54,074,533	49,255,893	9.8
August (61 per cent of industry)	1,734,583	1,607,649	7.5	55,801,224	52,913,483	5.4
September (61 per cent of industry)	1,766,587	1,647,945	7.3	55,525,272	53,267,877	4.3
October (64 per cent of industry)	1,963,579	1,889,255	4.0	67,520,070	65,068,938	3.8
November (67 per cent of industry)	2,229,742	2,115,957	5.6	69,480,163	66,988,456	3.8
December (67 per cent of industry)	2,392,167	2,224,830	7.5	79,448,980	71,860,433	10.6

TABLE III—CENTRAL-STATION OPERATIONS FOR THE ATLANTIC STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (58 per cent of industry)	$6,492,767	$5,628,718	14.5	259,098,542	238,733,320	8.4
June (54 per cent of industry)	6,067,780	5,578,311	6.0	244,936,886	221,315,464	10.8
July (54 per cent of industry)	6,152,169	5,583,309	10.2	263,580,299	235,068,939	11.8
August (55 per cent of industry)	6,224,896	5,755,515	8.2	264,717,319	237,984,895	11.2
September (55 per cent of industry)	6,608,221	6,221,000	6.1	270,974,533	252,648,550	7.3
October (67 per cent of industry)	7,451,220	7,232,063	3.1	358,458,539	351,362,247	2.1
November (69 per cent of industry)	8,373,772	8,157,966	2.7	361,364,405	364,155,759	0.7*
December (69 per cent of industry)	8,765,275	8,594,773	2.2	401,623,514	396,251,867	1.2

*Decrease.

TABLE IV—CENTRAL-STATION OPERATIONS FOR THE CENTRAL STATES (ILLINOIS EXCLUDED)

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (43 per cent of industry)	$3,200,553	$2,841,685	12.7	202,611,026	162,363,929	24.8
June (52 per cent of industry)	3,914,836	3,459,497	13.2	217,920,183	182,406,207	19.4
July (52 per cent of industry)	3,802,126	3,307,719	15.0	217,928,950	188,569,581	15.6
August (57 per cent of industry)	4,389,696	4,051,678	8.4	267,501,400	226,276,638	9.4
September (57 per cent of industry)	4,704,780	4,368,251	7.9	260,705,339	237,832,934	9.7
October (57 per cent of industry)	5,105,810	4,783,847	6.8	295,490,712	266,827,567	10.5
November (57 per cent of industry)	5,408,672	5,158,981	4.8	290,681,750	269,220,528	8.0
December (57 per cent of industry)	6,000,985	5,672,102	5.8	314,526,960	291,236,251	8.1

TABLE V—CENTRAL-STATION OPERATIONS FOR PACIFIC AND MOUNTAIN STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May (57 per cent of industry)	$1,525,729	$1,426,885	7.0	144,839,552	129,357,915	11.9
June (67 per cent of industry)	1,894,887	1,791,918	5.8	155,326,455	141,836,377	9.6
July (72 per cent of industry)	2,212,827	2,068,249	6.8	183,160,015	169,718,387	7.9
August (75 per cent of industry)	2,386,677	2,282,061	4.6	193,216,699	185,330,705	4.2
September (75 per cent of industry)	2,487,513	2,398,176	3.7	190,979,705	185,090,658	3.2
October (85 per cent of industry)	3,146,160	3,157,689	0.3*	245,966,868	252,047,828	2.4*
November (88 per cent of industry)	3,503,499	3,574,086	2.0*	255,651,947	269,467,354	5.1*
December (88 per cent of industry)	3,834,902	3,813,912	0.3	278,922,004	287,181,920	2.7*

*Decrease.

The statistical returns have been segregated into groups according to the population of the cities served (1910 census). The following arbitrary groups were chosen: Group 1, more than 100,000 inhabitants; group 2. between 100,000 and 50,000 inhabitants; group

3, 50,000 to 25,000; group 4, 25,000 to 10,000; group 5, 10,000 to 5,000 inhabitants. In each group there was a downward tendency for the percentage rate of growth in income for September, October and November, and with the exception of group 4, which experienced no change, all showed an upward tendency in December. In output, groups 2 and 5 continued to fall in the percentage rate of growth in December, but groups 1, 3 and 4 began to improve.

TABLE VI—COMPARATIVE FIGURES FOR 51 PER CENT OF INDUSTRY OVER A FOUR-MONTH PERIOD

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
September	$15,708,695	$14,694,205	7.0	782,450,267	733,754,420	6.8
October	16,967,816	16,443,831	3.3	911,982,671	876,944,255	4.0
November	17,840,812	18,185,093	1.7*	804,960,227	780,632,582	3.0
December	19,122,288	18,446,438	3.8	875,707,036	850,606,834	2.9

*Decrease

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December
INCOME:				
Group 1	8.0	4.2	2.6	2.6
Group 2	8.2	4.7	4.7	4.9
Group 3	4.2	1.2	0.5	3.3
Group 4	10.0	15.1	4.8	4.8
Group 5	9.1	3.5	1.5	3.2
OUTPUT:				
Group 1	5.5	3.2	0.5	3.1
Group 2	14.0	5.2	4.2	3.0
Group 3	2.7	4.6*	7.2*	6.8
Group 4	9.5	6.3	5.7	9.2
Group 5	4.0	2.9	2.6*	1.8

*Decrease.

TABLE VIII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December
INCOME:				
Group 1	5.8	5.0	6.1	7.9
Group 2	6.3	2.3	2.3	5.5
Group 3	7.0	6.1	9.7	11.4
Group 4	3.9	5.8	9.0	8.2
Group 5	17.8	8.0	3.9	5.5
OUTPUT:				
Group 1	2.0	4.2	6.9	12.5
Group 2	12.0	1.0	1.5*	5.9
Group 3	7.4*	6.6	7.5	11.0
Group 4	15.0	14.2	4.2	12.5
Group 5	9.7*	8.1*	8.3*	4.1

*Decrease.

TABLE IX—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December
INCOME:				
Group 1	7.8	6.2	3.0	1.6
Group 2	6.1	7.1	2.7	3.9
Group 3	7.9	1.4	0.3*	0.4
Group 4	8.3	6.8	4.8	7.9
Group 5	10.0	10.2	13.5	11.2
OUTPUT:				
Group 1	7.1	4.6	0.0	3.2
Group 2	15.6	10.3	5.0	4.3
Group 3	16.4	6.0*	8.5*	7.7*
Group 4	2.2	0.0	3.8	6.2
Group 5	26.8	46.5	57.5	11.1

*Decrease.

TABLE X—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December
INCOME:				
Group 1	7.7	7.0	4.7	5.2
Group 2	9.5	4.7	5.2	7.5
Group 3	0.0	4.0	4.0	7.5
Group 4	11.3	8.1	4.3	6.4
Group 5	9.5	1.6	0.5*	1.5*
OUTPUT:				
Group 1	5.7	6.3	2.4	4.2
Group 2	21.0	11.2	14.8	12.4
Group 3	4.4	5.0	6.6	12.4
Group 4	14.7	7.8	8.3	13.3
Group 5	21.0	5.0	4.9	13.0

*Decrease.

TABLE XI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December
INCOME:				
Group 1	7.5	0.3*	2.4*	0.6*
Group 2	13.1	2.0	1.1	1.0
Group 3	3.8	1.7*	3.5*	1.0
Group 4	17.7	2.9*	1.4	6.5
Group 5	4.4	0.1	3.1*	2.5*
OUTPUT:				
Group 1	2.3	1.6*	2.1*	0.0
Group 2	4.5*	13.0*	7.7*	13.0*
Group 3	2.7	7.3*	14.1*	14.2*
Group 4	12.0	7.1	4.4	3.7
Group 5	7.2*	1.1	2.9*	1.0

*Decrease.

Unless otherwise noted, the figures in Tables VII, VIII, IX, X and XI represent the percentage rates of growth for the individual groups for September, October, November and December.

Water-Power Motor Drive in a Minneapolis Flour Mill

An extremely flexible arrangement has been worked out by the Northwestern Consolidated Milling Company for one of its large flour mills at Minneapolis. This plant is driven by both a waterwheel set and a large synchronous motor connected to the same shaft. When water is plentiful the turbine wheel is operated at full load, pulling the mill and converting its surplus power into electrical energy in the motor unit, which is for the time operated as an alternating-current generator. The electrical energy thus generated, amounting to several hundred horse-power, is used to supply other mills and elevators operated by the same company. When, however, the output of the waterwheel is insufficient to pull the mill itself, the synchronous motor is called into service, taking its supply from the mill steam-turbine plant. In case of low water this motor is used to drive the whole mill. On still other occasions, when the mill is shut down and it is desired to utilize the water-power, the waterwheel can again be used to drive the motor unit as a generator, feeding its entire output into the mill system. In preparing the switchboard connections for this flexible arrangement it was, of course, necessary to provide for reversing the wattmeter connections by means of a reversing switch when the motor is operating as a generator.

PRODUCING NITROGEN COMPOUNDS

Electrical Processes for This Purpose Discussed by the New York Section of the A. I. E. E.

A joint meeting of the American Institute of Electrical Engineers and the New York Section of the American Electrochemical Society was held in New York City on March 12. Two papers were presented: "Fixation of Atmospheric Nitrogen," by Mr. Leland L. Summers, and "The Cyanamide Process," by Mr. Frank B. Washburn.

The paper by Mr. Summers dealt with the commercial production of nitrogen compounds by three electrical processes—(1) the Birckland-Eyde, (2) the Schonherr, and (3) the Pauling. In commenting on these the author called attention to the supply from natural sources, the necessity of producing substitutes at a competitive cost, the low efficiency of electrical processes utilizing thermal energy only, and the possibilities of important developments by combining electrical and chemical methods. Among the subjects discussed were the power-factor and electrode wear in electrical processes, efficiency and losses, the cost of making products, and the possibility of manufacturing nitrogen compounds with off-peak energy. The energy required per kilogram of nitrogen combined is 65 kw-hr. with the direct oxidizing process, 16.6 kw-hr. with the cyanamide process, 12 kw-hr. with the aluminum-nitride process, and 1.5 kw-hr. with the catalytic method.

Cyanamide Process

In the paper by Mr. Washburn it was pointed out that from 90,000 tons to 100,000 tons of fixed nitrogen is produced annually by arc and cyanamide processes, twice as much being manufactured by the latter method as compared with the electrical process. Some of the economic aspects of nitrogen fixation were discussed, the author being of the opinion that the arc process will be restricted to the production of nitric acid. The arguments which were presented tended to show that the cyanamide process will be employed most extensively. Considerable data were given on the comparative costs of producing nitrogen compounds by different methods.

Discussion

The discussion was opened by Dr. J. W. Richards, who reviewed the great progress made in recent years but emphasized the "wonderful inefficiency," from the thermal and energy standpoint, of all processes for the fixation of atmospheric nitrogen. The thermal efficiency of the nitric-acid-arc process is only about 1.4 per cent, while the cyanamide process fixes about twice as much atmospheric nitrogen per kilowatt-hour. There is a wide margin for improvement.

Mr. J. L. R. Hayden, in a communicated discussion, said that a series of experiments in Dr. Steinmetz's laboratory with arcs of different temperatures (produced by using different electrode materials, iron, titanium, carbon and copper) showed no direct relations of the NO concentrations to the arc temperature. He considers that the essential phenomenon in the arc is the dissociation of the oxygen and nitrogen molecules into N atoms and O atoms, which pass out of the arc and combine with each other according to the probability law.

Mr. D. B. Rushmore emphasized the point that civilization is absolutely founded on the layer of from 4 in. to 6 in. of soil on the surface of the earth. The conservation of this layer is an absolute necessity, and there is still very much to learn on fertilizing. He suggested the possibilities of development of water-powers in agricultural districts and asked as to the effect of the electric field in arc processes.

Dr. C. A. Doremus referred to a treatise published in 1802 by Felix Pascalis, in which he referred to the possibility of manufacture of nitric acid from nitrogen of the air according to the expectations of Citizen Guyton. It has required a world conflagration to make us in this country appreciate our possibilities.

Mr. F. V. Henshaw asked as to the requirements in the matter of geographical location of nitrogen-fixation plants.

Mr. Washburn replied that for pure cyanamide factories interior water-power plants serving adjoining agricultural districts would do, but that for the manufacture of ammonia-phosphate fertilizers cheap water transportation is as necessary as cheap water-power. He said, however, that the beef-packing business was successful in spite of very large shipping bills, and a great nitrogen industry will be also able to face successfully similar handicaps. But this means manufacturing at one point on the largest scale.

Mr. Summers, in closing, said in reply to Mr. Rushmore's last question that at the high temperature of arc processes dissociation is so active that though there is an electrical effect it will be overcome and the final effect be purely thermal. Ozone, on the other hand, is produced at low temperature.

Illumination of Cars

Considerable experimental work has been conducted under the direction of the New York Municipal Railway Corporation to determine the most desirable lighting system for the cars which will be used. Data obtained during these experiments and conclusions drawn from the results were given in a paper entitled "A Practical Study of Car-Lighting Problems," presented before the New York Section of the Illuminating Engineering Society by Messrs. W. G. Gove and L. C. Porter on March 11. The size of the cars, arrangement of seats, finish and construction made the problem of illumination somewhat unusual. The cars are 65 ft. long and 9 ft. wide inside. The headlinings and walls down to the window sills are enameled white; below that the walls are gray, the seats are upholstered in yellow rattan, and the floor is concrete. Some of the seats run parallel to the track and others transverse. Thirteen different systems were tested, the results being tabulated herewith. The lighting equipment finally adopted consisted of fifteen 56-watt bowl-frosted tungsten lamps supported in 6-in. opal reflectors arranged along the center line of the ceiling. These are supplemented by six 10-watt all-frosted emergency lamps. The illumination at 42 in. above the floor averaged 5.94 ft.-candles at normal voltage and was remarkably soft and uniformly distributed. The power required per square foot of floor surface was 1.44 watts, the effective lumens per watt 4.14, and the effective utilization factor 50.6 per cent. Among the factors considered in deciding on this equipment were the general effect and appearance, eye comfort, ease of reading when seated or standing, utilization efficiency, maintenance expense, power consumption and lamp depreciation.

Among those who took part in the discussion were Messrs. F. M. Brinckerhoff, Ward Harrison, S. G. Hibben, G. H. Stickney, Norman Macbeth and Dr. Haven Emerson. Mr. Brinckerhoff called attention to the commercial value of car lighting, such as its effect on renting advertising-card space and in drawing passengers from competing roads.

In response to a question he stated that, in his opinion, the most even distribution of light would be secured in a car when the interior cross-section has the form of a parabola and when the lighting units are set

on the exact focal center line. Limiting dimensions might preclude such a design, however.

Mr. Hibben quoted from 7 cents to 10 cents per unit per month as being the cleaning cost when the units are wiped dry three times a month and washed once in the same period. Dr. Emerson said that the New York Board of Health may call upon the society to join an advisory committee which will determine how factories, etc., should be illuminated. Mr. Stickney recommended finishing the headlining of cars in light colors to obtain efficient illumination and insure even distribution. He also pointed out that while the intensity of illumination on advertising cards may be increased by placing bare lamps near them it is not advisable to do so because the visual acuity will be impaired by the lamps being in the line of vision. Mr. Macbeth said that if advertising cards are set on white backgrounds they will not be so distinct as on darker surfaces. New types of interior-lighting units, reflectors and headlamps were exhibited by Messrs. G. H. Stickney, W. P. Horn and P. S. Bailey respectively.

RESULTS OF ILLUMINATION TESTS IN NEW SUBWAY CARS FOR NEW YORK CITY

Type of Illumination	Lamps: Regular	Lamps: Emergency	Reflectors	Foot-Candles 42 In. Above Floor: At Normal Voltage	Foot-Candles 42 In. Above Floor: At 85 per Cent Voltage	Total Watts Required	Watts per Square Foot	Lumens per Watt	Utilization Efficiency, per Cent
Direct	Ten 56-watt	Four 10-watt	6-in. Sudan No. 01225, opal	5.685	3.157	600	1.030	5.540	68.7
	Ten 56-watt	Four 10-watt	Holophane XI-40, clear prismatic	6.056	3.350	600	1.030	5.905	73.2
	Five 94-watt	Four 10-watt	Holophane XE-100, ditto	5.020	2.780	510	0.871	5.758	71.5
Semi-indirect	Twelve 80-watt*	Three 10-watt	None	7.695	5.144	990	1.692	4.649	58.4
	Ten 56-watt	Four 10-watt	Doric dishes and enameled trough	3.908	2.170	600	1.030	3.810	47.2
	Ten (in pairs) 94-watt	Ten 10-watt	Pyro No. 1209, glass bowls	5.688	3.165	990	1.692	3.361	41.5
	Ten 94-watt	Ten 10-watt	Pyro No. 1209 (ceiling insert)	6.133	3.383	990	1.692	3.624	44.7
	Ten 94-watt	Ten 10-watt	Pyro No. 1209 (different spacing)	5.554	3.059	990	1.692	3.282	40.5
Indirect	Ten 56-watt	Five 10-watt	Moonstone screens	4.834	2.680	610	1.042	4.635	57.6
	Twenty-four (three in cluster) 36-watt		Alexolite, enameled steel	5.060	3.210	864	1.477	3.426	46.3
	Twenty 36-watt	Five 10-watt	E-60 X-Ray in coves	3.514	2.230	770	1.316	2.670	36.3
	Twelve 94-watt	Five 10-watt	E-100 National X-Ray, inverted cones	8.463	4.700	1178	2.013	4.206	53.4
Direct	Fifteen 56-watt bowl-	frosted lamps	6-in. Sudan No. 01225, opal	5.940	3.850	840	1.440	4.140	50.6

*Opal-dipped turnip-shaped bulbs.

Protective Coatings for Line Structure and Equipment

BY R. D. COOMBS

To prevent metallic transmission and distribution line supports and equipment from deteriorating they should be covered with some protective coating. In the writer's opinion, structures with small or medium-spread bases can be protected more satisfactorily and economically by painting than by using galvanized sections, provided that their maintenance is not grossly neglected.

Inasmuch as the adherence of the first or shop coat affects the character of all subsequent coats, painting specifications should require that the metallic surfaces be thoroughly cleaned of all mill scale, rust and dirt and that no paint be applied in the rain or dusty atmosphere. Further, the application of the second or field coat is open to improvement in that careless workmen frequently paint over mud spots or blisters. If the base coat does not adhere to the metal, subsequent coats applied over it will flake off, leaving the metal exposed to corrosion. The inexpert use of paint thinners in general or the addition of benzine to ready-mixed paints may effect a little saving in the original cost of labor and material, but will not be economical in the long run. Field painting should follow the stringing of wires so that the final coat will be unmarred by erection operations. Shop coats of linseed oil instead of paint are not advisable as they are liable to blister and peel before or after the field coat is applied.

In repainting just as much, if not more, care is required to remove dirt and paint where rusting has occurred beneath the previous covering. All paints should be stirred thoroughly before using, particularly the heavy-pigment paints such as red lead. Paint containers which have been opened should be kept under cover; otherwise water, dirt, etc., will get into the contents or the paint will dry out. In filling painters' pails from the stock container the contents of the latter should be thoroughly stirred. The writer recommends applying a plaster of "paint skins" to steel structures where they are to be incased in concrete, but never to the large areas of the superstructure.

Under favorable climatic conditions galvanizing is thought to be more economical than painting for wide-base towers erected in rough, unsettled country where all maintenance operations are expensive. It is generally assumed, however, that galvanizing does not afford proper protection near coke ovens, smelters, steam plants, etc., or near the seacoast.

In order to make the layer of zinc adhere firmly the steel should be "pickled" in a weak solution of sulphuric acid to clean the surface. Next the metal should be immersed in a bath of hydrochloric acid, after which the metal is heated either in an oven or by placing over a bath of hot zinc. The material to be coated is then immersed in molten zinc until the covering is complete. Before entirely removing the coated article from the bath excess zinc should be allowed to drain off.

All metal fed into the molten zinc should be passed through a flux of sal ammoniac which can be retained on the surface of the bath at one end by removable plates set vertically in the container. The exit of the bath may contain some "temper metal" for increasing the luster and insuring a more fluid bath. The mixture may consist of tin, aluminum and spelter. The amount of tin should be small, however, since an excessive amount, particularly in the inside layers, may cause a brittle coating. Inasmuch as there are several grades of spelter, it is advisable to use "high grade" for galvanizing wire and "prime Western" for structural shapes. Standard specifications for spelter were adopted by the American Society for Testing Materials at its meeting in 1911.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Direct-Current Generators.—B. G. LAMME.—In an instalment of the long serial on the engineering evolution of electrical apparatus, the author continues to discuss the development of the direct-current generator in America, and deals especially with field poles and windings, commutation, equalizing connections on armature windings and commutator mica. The paper is to be continued.—*Elec. Journal,* March, 1915.

Lamps and Lighting

So-Called Half-Watt Lamps.—The nitrogen-filled tungsten lamps are called in Germany "half-watt lamps." The reason is that they were originally intended to replace arc lamps, and the specific consumption per candle-power was based on the measurement of the lower hemispherical candle-power. On the other hand, the incandescent lamps have in the past been rated generally by the horizontal candle-power, that is, by the candle-power in a direction perpendicular to the axis of the lamp. Nitrogen-filled tungsten lamps now on the market for 100 cp and 200 cp and 110 volts and 220 volts which are no longer intended to replace arc lamps should not be called half-watt lamps. According to the form of the filament, the distribution of the candle-power in space may be very different for lamps of the same mean spherical candle-power. Incandescent lamps should be rated by the mean spherical candle-power. The name "half-watt lamps" for nitrogen-filled tungsten lamps has been abandoned by the two largest German manufacturers, who now use the names "nitra lamp" and "osram-azo lamps."—*Elek. Zeit.,* Feb. 4, 1915.

Generation, Transmission and Distribution

Automatic Protection of Motor-Generator Sets.—E. F. NELSON.—An illustrated article on the automatic protection which must be provided for motor-generator sets operating in parallel on high-voltage direct-current systems. The direct-current side should be provided with overload, reverse power and shunt trips, and the alternating-current circuit-breakers should have low-voltage and overload trips.—*Elec. Journal,* March, 1915.

Traction

Three-Phase Traction.—F. SANTORO AND L. CALZALORI.—The first part of an illustrated article on the three-phase traction system used on the Giovi line in Italy. The conditions of the line are first given as they were at the time of the operation by steam, and this is followed by a critical account of the results obtained after electrification. The results are given in the form of tables, diagrams, etc. The article is to be continued.—*La Lumière Elec.,* Feb. 13, 1915.

Finishing Temperature of Rails.—W. R. SHIMER.—A paper read before the American Institute of Mining Engineers on the effect of finishing temperatures of rails on their physical properties and microstructure. The author gives the results of extended tests carried out by the Bethlehem Steel Company. One of the most important results is that rails rolled from re-heated blooms are more ductile than those rolled direct from the ingot, regardless of their finishing temperature. The microstructure appears to be controlled more by the rate of cooling from above the critical point than it does by the temperature at which it was finished.—*Bulletin Amer. Inst. Min. Eng.,* March, 1915.

Railway-Motor Design.—R. E. HELLMUND.—An article in which are discussed various considerations in the design of railway motors and especially insulation design. The author discusses the available insulating materials, the methods of treating and impregnating, and the selection and application of insulation—*Elec. Journal,* March, 1915.

Automobile Motors.—T. H. SCHOEPF AND A. L. BROOMALL.—An article illustrated by diagrams on the requirements of motors for electric vehicles. They are of the series-field type, with the field coils grouped in pairs for series or series-parallel connection. For passenger cars use is made of the magnetically saturated motor; for commercial trucks, of the magnetically unsaturated motor. Ruggedness of mechanical construction and lightness in weight are further requirements. —*Elec. Journal,* March, 1915.

Installations, Systems and Appliances

British Central-Station Statistics.—The annual statistical tables, giving data on 547 electric supply stations in Great Britain, with respect to ownership, management, electric equipment, operation details, tariffs in use, etc. For the first time a column is included for tariffs for charging electric vehicles, from which it appears that facilities in this direction are becoming available to a reasonable extent. There are also certain tariffs which appear to be unusual. Thus, the announcement is made by one particular undertaking that batteries are charged at "the rate of 2d. (4 cents) per volt." This seems to be a curious basis. In regard to rates for energy for general purposes it is noticeable that the company serving Sevenoaks and the surrounding districts charges at the rate of 7d. (14 cents) per kw-hr. from sunset to 10 p. m. and 2d. (4 cents) per kw-hr. at other times. In some cases the rate for heating is higher than that for cooking, but whether this is desirable is open to question. In one or two instances the rate for cooking takes such a form as 2d. (4 cents) per kw-hr. in winter and 1d. (2 cents) per kw-hr. in summer. The price of competitive gas is an important factor, and in Sheffield the price of this commodity is as low as 10d. (20 cents) per 1000 cu. ft. for motor service, yet the Sheffield undertaking is successful in obtaining a good motor load. The statistical tables are published as a supplement, and a brief editorial summing up is given in London *Electrician,* Feb. 19, 1915.

Control of Public Utilities.—An editorial discussing the difficulties involved in the control of companies engaged in public service work. "In the United States these matters are largely in the control of commissions, which regulate the maximum rates that consumers shall be charged. This method appears to serve very well, but it will no doubt be realized that a commission, in its decisions, must always lag behind the policy of a really progressive company, for the simple reason that, in order to develop its business, the latter would take certain risks that a commission would not feel justified in forcing upon the company. This being so, we reach the conclusion that progressiveness in a company is more important than the enforced decisions of a commission. Nevertheless, a commission can carry out very useful work. It can permit certain maximum rates which are desirable and certain profits without which a business cannot be properly developed." Referring to the recent American Institute paper by Mr. F. G. Baum, the statement is made that it does not seem to be realized in the United States that extensions of works and plant involve an unremunerative period just as much as does the original enterprise, and that it is highly desirable that an extra return should be allowed upon the capital expenditure upon such extensions. Baum

points out that if the capital of a company earns nothing at the start and becomes remunerative at the end of six years the loss of interest amounts to about 18 per cent on the investment. "Thus all unremunerative extensions should be treated in such a way that from 10 to 20 per cent on the capital should be earned on account of these initial periods. When we come to general extensions of business, we find that this part of the subject is bound up very closely with the question of class rates. . . . Although we may reach a time when electrical energy, whatever the use, will be supplied at a very low flat rate, we have not yet reached that fortunate age, and there is, consequently, no denying that at the present time satisfactory progress can be made only by means of a proper application of class rates."—London *Electrician*, Feb. 19, 1915.

Hydroelectric Installation on a Coffee Plantation.—J. H. TORRENS.—The author gives a brief account of the conditions existing in Guatemala, where native labor still performs many operations now done by machinery in more developed countries. He then gives a description of the hydroelectric plant of the Finca Ona plantation, which is the largest in Guatemala. The process of preparing coffee for the market and the different operations carried out by the aid of electric motors are described.—*Gen. Elec. Review*, March, 1915.

Cost Keeping in the Central Station.—An article on log books and sheets for electrical central stations, giving details of the card-index system employed, etc.—London *Elec. Review*, Feb. 19, 1915.

Wires, Wiring and Conduits

Steel and Iron Wire for Overhead Lines in Germany.—The German Association of Electrical Engineers has issued a new statement (signed by G. Dettmar) concerning the substitution of iron and steel wires or cables for copper for overhead lines, on account of the lack of copper at present in Germany due to the stoppage of importation. The Felten & Guilleaume Carlswerk has made several tests of various types of iron and steel

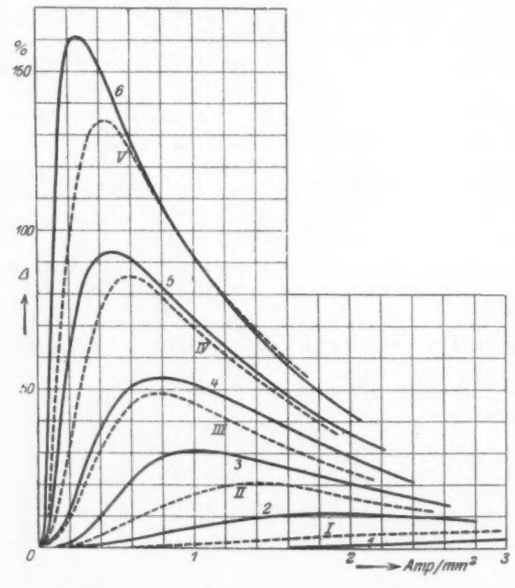


FIG. 1—CURVES SHOWING RESULTS OF TESTS ON "HOO"

wire and cables, especially with respect to the increase of the alternating-current effective resistance over the direct-current resistance. Fig 1 gives the results for the material called "Hoo." Curves 1, 2, 3, 4, 5 and 6 relate to iron wire of 1, 2, 3, 4, 5 and 6 mm diameter respectively, while the curves I to V relate to seven-conductor stranded cables of 1 to 5 mm diameter. The curves give the increase of the effective resistance for alternating current of fifty cycles per second as a function of the current density for non-insulated, zinc-plated "Hoo" wire with a tensile strength of 70 kg per sq. mm. Fig. 2 gives the corresponding results for another steel called "Hooo." This is purer and more expensive than "Hoo" and has a conductivity higher by 17

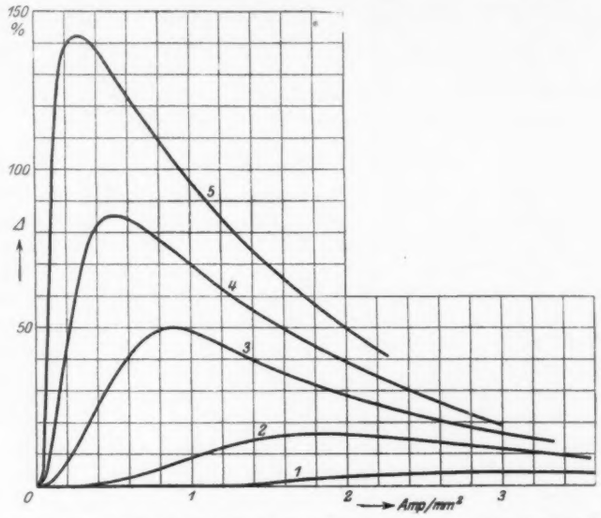


FIG. 2—CURVES SHOWING RESULTS OF TESTS ON "HOOO"

per cent. For this reason "Hooo" is the better material for direct-current lines, but this is no longer true for alternating-current lines, on account of the higher permeability and the increase of effective resistance due to the skin effect. Pure Swedish iron wire of the brand G.S. is still more unsuitable for alternating current for the same reason. Annealing of the wire has the effect that the increase in effective resistance due to the skin effect is greater than is the increase in conductivity. For the present, the best iron wire for alternating-current lines is therefore zinc-plated "Hoo," with a tensile strength of 70 kg per sq. mm and an average conductivity of 7.3. The original publication contains also diagrams of the results obtained with stranded cables and points out that the method of stranding the wire has an effect on the increase in effective resistance. Rules are given for stranding the wire into cables to obtain the best results. Diagrams are also given on the results of tests made by the Siemens-Schuckert company with respect to the same matter.—*Elek. Zeit.*, Jan. 28, 1915.

Wiring.—H. C. TOFIELD.—The conclusion of his illustrated article on modern wiring work, particularly in bad situations. The author describes a tumbler switch and a non-corrosive lamp-holder devised by White, a watertight wall plug devised by Reyrolle, and watertight distribution boards, and gives a few notes on motor wiring and portable apparatus.—London *Elec. Review*, Feb. 19, 1915.

The Heating of Buried Cables.—A brief note stating that a further report has been issued by the (British) National Physical Laboratory on the experiments with regard to the heating of buried cables which are being conducted under the auspices of the research committee of the Institution of Electrical Engineers. At Bristol tests have been carried out with cables ranging from 0.05 sq. in. to 0.3 sq. in. laid direct in the ground, subjected to constant loads. The conductor resistance was measured by a bridge method, superimposing on the main alternating current a small continuous current for this purpose. An accuracy of measurement of the order of 0.1 per cent was attained, but the current could not be kept constant to nearer than 1 per cent. Determina-

tions were also made of the amount of moisture in the soil at the actual depth at which the cables were laid and of the temperature of the soil. Tests on special loads were also made at Wolverhampton on 0.5-sq. in. and 0.75-sq. in. cables, one in a duct and the other solid in bitumen. Tests under normal conditions of load have also been made at Marylebone on 2-sq. in. cable carrying about 2400 amp for about fourteen hours a day, and a special modification of the Callender temperature recorder is in use on tests at Marylebone with a number of 1-sq. in. cables in a twenty-way duct, and a Wolverhampton with cables laid solid and cables drawn into four-way or six-way ducts.—London *Elec. Eng'ing*, Feb. 18, 1915.

Electrophysics and Magnetism

Conductivity of Selenium.—F. C. BROWN.—An account of an experimental investigation of the electrical, the photo-electrical and the electrochemical properties of certain crystals of metallic selenium, with certain applications to crystal structure. The author's results show: (1) That when a selenium crystal is illuminated at certain points the conductivity of the entire crystal is increased, (2) that when pressure is applied to the crystal only that part of the crystal under pressure is altered, (3) that electrical forces alter the conductivity only of that part directly under the forces, and further that the influence is exerted only in the direction of the electrical force. The direct conclusion is that light action has to do with a mechanism essentially different from electrical stresses or mechanical stresses. The author suggests the following notions about the structure of the crystal of selenium. When in the dark a crystal has no free electrons in the ordinary sense. While a crystal conducts electricity when in the dark, yet this conductivity is small compared with that of the metals. This conductivity arises from electrons that are pulled from one atom to the neighboring atom and so on by the electrical forces across the crystal. By some mechanism, no doubt because of its electromagnetic properties, the light can lower the degree of stability of many or all of the electrons throughout the crystal. These same electrons may have their degree of stability yet further lowered by mechanical pressure. The lower the average stability of the electrons the greater will be the current with a given potential difference. With a greater potential difference the same light intensity would therefore seem to produce a greater change of conductivity. After removal from their fixed positions the electrons may behave, until reunited in the structure, somewhat as the traditional electron. The action of light is not local. By an indirect mechanism operating everywhere in the crystal the electrons are made less stable or temporarily free. The effect is uniform at almost all points. The hypothesis bears some resemblance to the accepted theory of electrolytic conduction, the distinctive feature being that only electrons move from one center to the next in the chain of centers between electrodes. This view requires that the crystal shall have fixed electrons in its structure but no permanently free electrons.—*Physical Review*, February, 1915.

Insulating Properties of Solid Dielectrics.—HARVEY L. CURTIS.—An account of an extended experimental investigation, in which the author discusses methods of measuring very high resistances and gives diagrams showing how they may be applied to the measurement of volume resistivity and surface resistivity. The volume resistivities of more than sixty materials are tabulated. The effect of the humidity of the surrounding air, of the temperature of the specimen, and of the magnitude and length of application of the impressed voltage, is discussed. The surface resistivity is due to a surface film, usually of water or oil, on the insulator. This is generally the important factor in determining the leakage between two conductors insulated by a solid dielectric. However, for insulators having a volume resistivity less than 10^{14} ohm-cm placed in an atmosphere having a humidity less than 25 per cent, the greater part of the current may flow through the body of the insulator. The surface resistivity of most materials changes through wide limits when the humidity of the surrounding air is varied. It is often a million times as great at low humidity as at high humidity. The effects of temperature and exposure to light are also discussed.—*Scient. Papers, Bureau of Standards*, No. 234.

Units, Measurements and Instruments

Electric Resistivity of Molten Metals and Their Use for Pyrometry.—EDWIN S. NORTHRUP.—A brief abstract of an American Physical Society paper on the linear resistance change with temperature of certain molten metals. Copper and tin have been studied to 1680 deg. C., lead to over 1600 deg. C., gold to 1500 deg. C., silver to 1340 deg. C., bismuth to 750 deg. C., and their change of resistance with temperature when molten has been found, within the limits of accuracy of the measurements, to be linear. Lead and tin, particularly the latter, are shown to constitute excellent thermometric materials for the accurate measurement of high temperatures which may be read with apparatus that reads on a uniformly spaced scale directly in degrees centigrade. Several features and relations of interest respecting the resistivities of the above metals are pointed out.—*Physical Review*, February, 1915.

Book Review

VALVE GEARS. By Prof. Charles H. Fessenden. New York: McGraw-Hill Book Company, Inc. 170 pages, 171 illus. Price, $2.

The author of this book has succeeded admirably in achieving his expressed intention to produce an elementary treatise on valve gears. A commendable feature is that the text is confined solely to the valve gears of steam engines, and the discussion is limited to those forms that are best known and that are most commonly used. The Zeuner and the Bilgram diagrams are the only ones employed by the author in working out the various problems, because of their wide range of application, although they are modified slightly in the solution of certain problems by the introduction of features from the Reuleaux diagram. The scope of the book is such as to include the D-valve, the piston valve, multiple-ported valves, valves with riding cut-off and steam-pump valves. In addition, there are chapters on reversing gears, such as the Stephenson link motion, the Walschaert valve gear and the Joy valve gear. In connection with these types of reversing gear a method is given whereby an equivalent eccentric may be found for each, thus enabling approximate solutions of valve problems to be made with the ordinary valve diagrams. The concluding chapters are devoted to Corliss valve gear and poppet valve gear respectively. Each of the numerous examples is solved fully by both the Zeuner and the Bilgram diagrams, to illustrate the application of each form, and many other examples are given by which the student may test his grasp of the principles presented. The book is written primarily as a text for use in engineering colleges, but it will be found of interest and value to any engineer who wants to work out the relations between the steam distribution and the proportions and adjustments of the valve.

POWER AND OPERATING SECTION

CLEANING FIRES UNDER BOILERS

How to Rid a Furnace of Clinkers, Bank Fires and Otherwise Care for Boilers

To burn fuel efficiently it is necessary to clean the fires periodically. Some excellent advice on this subject is contained in a paper prepared by Mr. Henry Kreisinger for the Bureau of Mines. As the clinker and ash sink to the grate of their own accord, they can be separated from the combustible material economically by scraping the coal to one side until the refuse has been

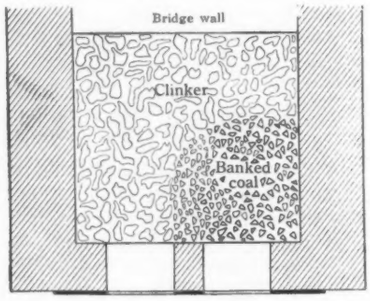


FIG. 1—METHOD OF BANKING FIRES

removed. Among methods of cleaning which are favored by plant operators are the side method and the front-to-rear method. By the first method the good coal is scraped and pushed from the side to be first cleaned to the other side, the fire tools being used as shown in the accompanying drawing. If the clinker sticks, a slice bar may have to be forced underneath the mass to loosen it from the grate or side wall, and to break it up so that it can be pulled out with a hoe. When all the lumps are loosened and broken they are collected with a hoe at the front of the grate so that they can be pulled out of the furnace into a wheelbarrow set close to the furnace door. Gathering all of the refuse on the grate before pulling any out protects the fireman from the intense heat which he would have to endure if the refuse were drawn into the wheelbarrow gradually. After one side of the grate has been cleaned, the coal on the

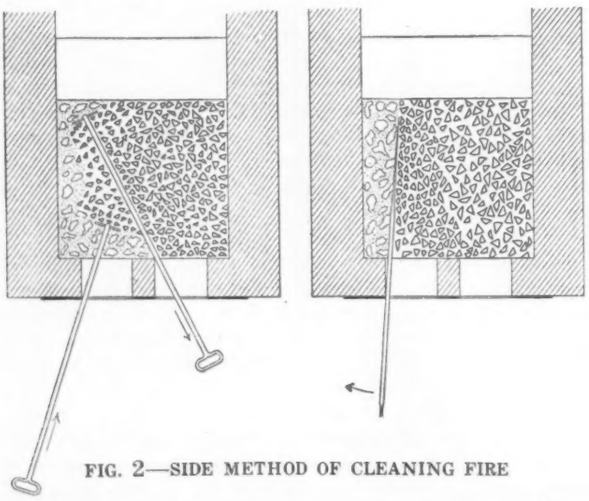


FIG. 2—SIDE METHOD OF CLEANING FIRE

opposite side can be scraped over and enough fresh coal added so that the entire grate can be covered when cleaning is done. If the boiler is to carry load during cleaning, it may be necessary to add fresh coal before any cleaning is done. During cleaning it is advisable to keep the damper partly but not entirely closed. After firemen have become familiar with this method of cleaning, they can clean the furnace for a 200-hp boiler in about ten to twelve minutes.

In the front-to-rear method of cleaning, as the name implies, the burning coal is pushed with hoe against the bridge wall instead of to one side. If the furnace has two doors, it is usually preferable to clean one-half of the grate at a time, unless the grate is very small. After the refuse has been removed as described for the side method, the burning coal is pulled forward to the bare grate and leveled. Fresh coal is then added, and the furnace is ready for its regular operation. The front-to-rear method is somewhat quicker than the side method, but not so thorough, because some clinker is always left at the bridge wall. Therefore, if the front-to-rear method must be used while the boiler is under load, it is advisable to employ the side method after the boiler is taken out of service at the end of the day.

If clinkers lie close to the grate and shut off the air supply, temporary relief can be obtained when it is impossible to clean the boiler thoroughly by running a slice bar under the clinker and lifting it slightly. Care should be taken, however, to allow as little as possible of the burning coal to get under the clinker, otherwise it will soon begin to melt and fill the apertures in the grate.

In plants where fires are banked over night the after-shift cleaning should be done early in the morning, or

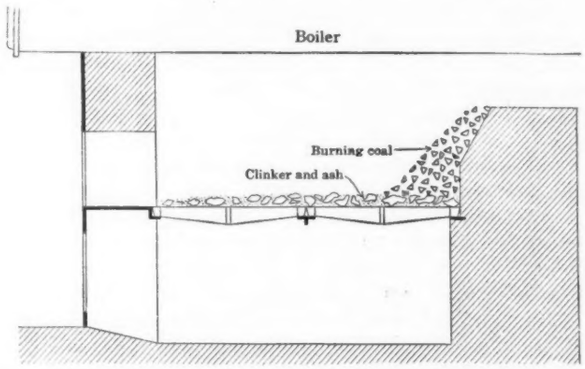


FIG. 3—FRONT-TO-REAR METHOD OF CLEANING FIRE

about two hours before steam is needed, so that the clinker will have time to cool off before being removed. To allow the clinker near the bridge wall to cool, it is advisable to bank the fire on the front part of the grate near one of the doors. Before starting the fires in the morning the clinker can then be pulled out without previously handling the burning coal. The damper should be nearly closed during the process of cleaning a banked fire.

The majority of bituminous coals cake or fuse into a crust, particularly when they contain a large proportion of slack; therefore the grates on which they are burned should contain large air spaces to allow the ash to fall through into the pit and prevent an accumulation on the grate. The air spaces should not be less than 0.5 in. wide, but for some coal may be as wide as 0.75 in.

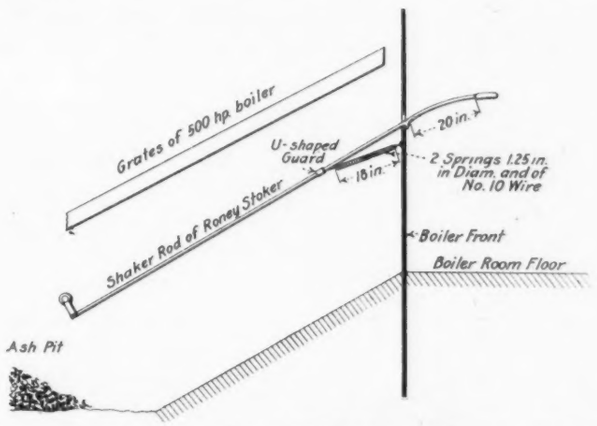
Causes of Clinkers and Remedies

The most common causes of clinker formation are: Excessive stirring of fires, burning coal in the ash pit, slack in the coal, closed ash-pit doors, and preheating

the air admitted under the grate. Clinker forms in thick fuel beds because the insufficient air supply through the grate permits the ash to become heated in a reducing atmosphere of carbon-monoxide. Some firemen add such large quantities of coal that crusts form on the surface of the fuel bed and must be broken up to allow the air to pass through. In doing this with a slicing bar firemen frequently lift the ashes and small pieces of clinker to the surface of the fire, thereby exposing the refuse to a high temperature and reducing gases, which quickly convert it into sticky clinker that may adhere to the grate bars or clog up the air passages. If coal is allowed to fall through the grate and burn in the ash pit, the heat may melt the ashes on the grate, allowing the fused material to fill the apertures. In some cases clinkering has been relieved by spreading a few shovels full of crushed limestone over the grate when starting from the banked fire, or after cleaning. The limestone should be broken to the size of a walnut.

Saving the Muscles in the Fireman's Back

In the Washington Street power house of the Merchants' Heat & Light Company, Indianapolis, Ind., the most severe task of the firemen—that is, shaking the grates of the stokers—has been made comparatively easy. Twin springs 18 in. long and 1.25 in. in diameter, and made of No. 10 steel wire, have been placed on each shaker rod. When a fireman now releases the dog which holds the shaker rod in the "up" position the weight of the grates, aided by a slight push, sends the rod to its



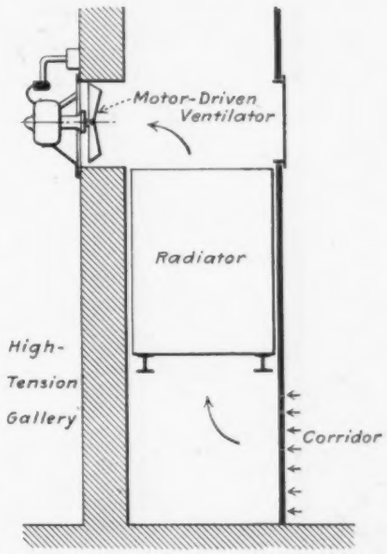
SPRINGS ADDED TO SHAKER RODS IN AUTOMATIC STOKERS

extreme "down" position and dumps the ash off the lower end of the grate. With the rod in this position the springs are at their point of maximum tension, and the rebound, aided by such a pull as can be exerted by a medium-sized fireman standing flat-footed on the floor, returns the rod to its original position and latches the dog. In fact, the rods can be worked so easily now that Mr. M. L. Addington, chief engineer for the company, in demonstrating the usefulness of the springs, easily returned one of these rods to its "up" position by using only one finger to exert the upward pull.

When a stoker is to be equipped with springs the shaker rods are removed and holes are drilled as shown at the lower end of the spring in the sketch herewith. A U-shaped piece of strap iron is then shaped and drilled so that it will slip over the shaker rod, and the holes in the strap iron coinciding with those in the rod allow this piece, when bolted in place, to serve as a guard to prevent the springs from becoming unhooked at the lower end. The distance between the upper and lower suspension points of the spring is made about 2 in. shorter than the over-all length of the spring, so that when the rod is in its "up" position the spring is compressed somewhat.

Heating of High-Tension Galleries

If steam or hot water is employed to heat high-tension switch galleries, there will be a chance of the radiators or pipes breaking and allowing water to flood



HEATING SYSTEM FOR HIGH-TENSION GALLERIES

the compartments and short-circuit the high-voltage conductors. This danger is prevented, however, at the generating station of the United Electric Light & Power Company, New York City, by installing the radiators in compartments between the corridors and the galleries and forcing the heated air into the latter by motor-driven fans. The corridor side of the radiator compartment is covered with a grating. With this arrangement ventilation is afforded, and in case a radiator bursts the water will be conveyed down a shaft into the basement, where it will be discharged into the sewer.

Phasing Out After Cable Joints Are Made

Instead of requiring its construction men to "phase out" cables before each joint is made, the distribution department of the Edison Electric Illuminating Company of Brooklyn, N. Y., saves time by allowing the men to make the joint without any regard to the phase relations, changing the terminal feeder connections

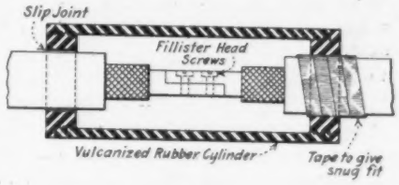


FIG. 1—REMOVABLE SLEEVE FOR FEEDER TERMINAL CONNECTION

to give the proper phase relation after the installation is completed. Continuity tests can be carried on from the terminals of the cable while the joints are being completed, thereby relieving the construction men of the responsibility of testing and allowing them more

time in which to make the actual joint. To facilitate "phasing out" after the installation is completed, the company employs separable joints in each terminal station, inclosing them with removable sleeves like that shown in the accompanying drawing. Lap joints are employed inside these sleeves, and are held together by fillister-head screws. The sleeves consist of a vulcanized

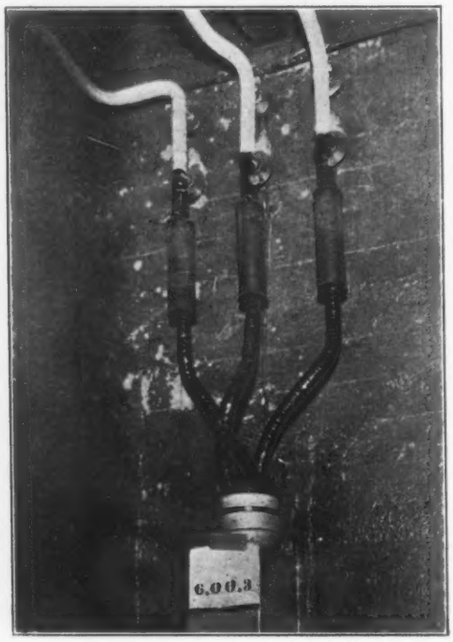


FIG. 2—REMOVABLE SLEEVES COVERING CABLE JOINTS

rubber cylinder into the ends of which screw rubber caps which fit loosely over the cable insulation. One of the caps is maintained in place by wrapping the cable which it surrounds with a thin layer of rubber tape sufficient to make a snug fit. If it becomes necessary to reconnect the feeders at the terminal station to give the proper phase relation, the cylinders can be unscrewed from the snugly fitted caps and slipped along the cable while the joints are being reconnected. The accompanying illustration shows one of these removable sleeves installed on feeders at one of the company's substations.

The Responsibilities of Owners of Underground Utilities in Electrolysis Prevention

In an address on the subject of electrolysis before the recent Minneapolis convention of the Western Association of Electrical Inspectors, Mr. Burton McCollum, of the United States Bureau of Standards, Washington, D. C., expressed the view that owners of underground utilities have distinct responsibilities in the prevention of electrolytic damage to those utilities, no less than the traction companies whose return currents are the direct cause of the trouble.

In considering the subject of regulations for the mitigation of electrolysis, it should be borne in mind, declared Mr. McCollum, that while the railway companies are to be held chiefly responsible for reducing stray currents to as low values as are commercially practicable, the owners of underground utilities must also be considered to have certain responsibilities, particularly in so far as new construction work is concerned in territory already occupied by electric railways.

There are many things that pipe-owning and cable-owning companies can do at a very slight additional expense which will go far to reduce electrolysis trouble, provided such measures are taken at the time the pipes or cables are installed. For example, in new work or repairs, pipe lines should be laid as far as possible from railway tracks.

Where the density of service connections is sufficient to justify the use of two mains, one on each side of the street, these twin conduits should be laid down in this way in order to eliminate the necessity for running services across and under the railway tracks. The foregoing is quite common practice in many places where the utilities are highly developed, and it could frequently be extended to new work with considerable improvement in local electrolysis conditions.

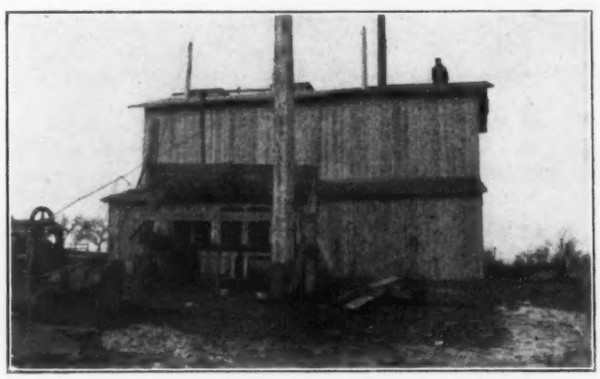
Use of Insulating Joints in Mains

Further, in laying new mains or repairing old ones, it is very simple and inexpensive to install a sufficient number of insulated joints largely to reduce stray currents in that portion of the pipe network, and such construction should be encouraged in every practicable way. Wherever it is necessary to run service pipes across the street under railway tracks, care should be taken either to lay them as far as practicable below the tracks or else to provide substantial insulation between the service pipe and the track, or between the service and the main by means of insulated joints. The latter plan will generally be found cheapest and most effective.

In view of the fact that excessive drainage of current from one pipe system may set up a condition of serious danger in a neighboring system, measures should also be taken so to restrict the drainage of current from any one underground metallic structure that it will not be maintained at a potential sufficiently lower than that of surrounding structures to bring about any serious injury to these structures.

Drying Large Transformer Units Electrically

A newly erected transmission line between Fostoria and Tiffin, Ohio, has its terminus at the latter city in a bank of three large transformers housed in a temporary frame substation. After a wintry trip from the factory these transformers needed to be thoroughly dried before being put into service, and a part of the equipment used for this purpose is shown in the photo-



DRYING TRANSFORMERS IN A TEMPORARY SUBSTATION

graph herewith taken in front of the temporary station. The other and invisible part of the drying apparatus inside the house consisted of a 25-kw, 110/220-volt electrically operated air heater, a blower, a 2-hp motor and a water rheostat. The coils of the air heater were supplied with energy from the company's station. The water rheostat included in the circuit allowed the operator to control the flow of energy through the circuit

and hence the temperature of the air delivered into the large transformers. The two transformer banks shown outside the station supplied energy to the heater and to the 2-hp motor.

Since facilities for removing the transformers from their tanks were not at hand when these units were dried, the coils and core were dried in the tanks. At the time this note was written it was expected that an average temperature of 80 deg. C., maintained for three days and nights, would drive out all of the moisture. To be sure of the dry condition of the windings, however, a megger was at hand and the factory man in charge of the drying operations was prepared to test each unit for insulation resistance before applying high potential to the coils of the transformer.

Protecting the Vital Points of a Tower

A steel tower set in concrete is most vulnerable at the ground line—that is, at the points where the tower legs enter the concrete base—because these are the points of greatest leverage and the places at which the twin destroyers, moisture and temperature, attack the steel with greatest ferocity. It matters little how carefully the concrete base is rounded to drain the moisture from the steel, for in spite of the best efforts there is generally a crevice of sufficient size between the concrete and the steel to harbor a few drops of water after each rainstorm and after each heavy dew. In time, and in spite of paint, these drops of moisture aided by their ally, temperature, make certain inroads on the unprotected steel.

There are several factors which have made it difficult to set poles in concrete in such a manner that water will run immediately away from tower bases. For instance, a 65-ft. square-base tower standing in a slight breeze vibrates as the green concrete is poured, and these small vibrations transmitted to the tower base slightly but surely force the newly poured and setting concrete away from the steel and leave at the base of the tower a crevice almost imperceptible to the eye but nevertheless a crevice. Then, too, concrete has been known to shrink in setting, and this shrinking action may become a factor in producing an opening for moisture.

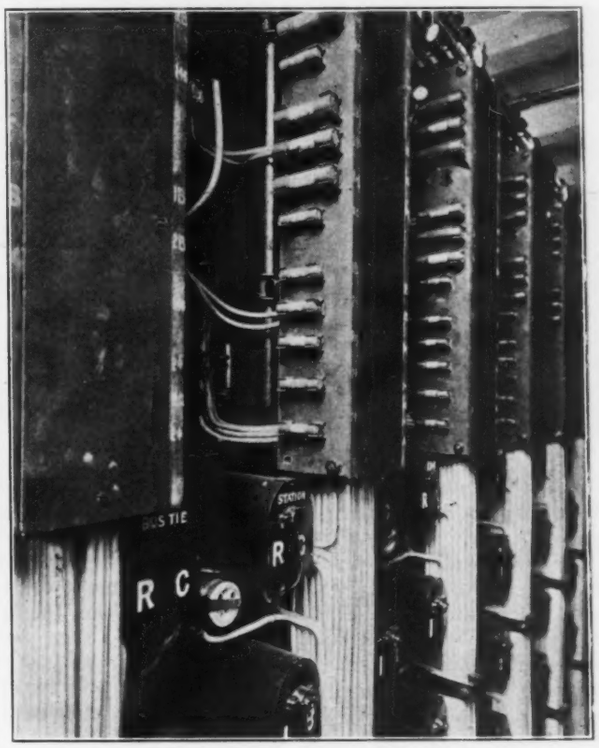
A TOWER SET IN CONCRETE BEFORE THE PITCH HAD BEEN POURED

But, regardless of what the cause or causes of the crevices may be, the construction men of the Ohio Light & Power Company at Tiffin, Ohio, believe that they have a means of decreasing, if not entirely eliminating, this trouble. As indicated in the photograph herewith, small trenches about 2 in. or 3 in. deep are dug in the green concrete at the base of each tower leg and angle-brace. Later, when the concrete has hardened, these trenches are poured full of asphaltum or pitch of a brand which will neither crack in cold weather nor run in the heat of the sun.

In the way described a water-tight joint is secured between the pitch and the steel and between the concrete and the pitch, and with a little care exercised in applying the pitch this joint can be made so that water will not be retained against the steel. This method of making water-tight joints is being used on the 33,000-volt line between Tiffin and Fostoria, and it is expected that the idea of thus protecting the towers in their vital parts will result in a very material increase in the life attained by these structures.

Arrangement of Control Wiring on Narrow Panel

Where space accommodations do not permit the installation of full-width panels it is not always possible to cleat the control wiring to the back of the boards in the usual manner, especially if a large amount of remote-control equipment is installed thereon. The accompanying illustration shows how this difficulty was circumvented at the 187th Street station of the United Electric Light & Power Company, New York City. The wires are grouped into vertical risers which are held in clamps attached to the board so that the risers form barriers between adjacent panels. At the top of these risers near the load center of each section are fuse panels supported with their faces at right angles to the switchboard. Wires lead from the fuse terminals to apparatus on the switchboard. Arranged in this manner, the fuses can be replaced easily and their terminal boards and vertical risers do not interfere with work which it may become necessary to do on the rear of the board.



ARRANGEMENT OF CONTROL WIRING AND FUSES

COMMERCIAL SECTION

Electric Cooking Grows in Popularity at Wildwood, Ohio

The plot of ground upon which thirty houses now stand in the suburb of Wildwood near Toledo, Ohio, was a thicket two years ago. As each of these houses was built an electric stove was placed in it. Energy for cooking and lighting is supplied by the company promoting the scheme, the Wiltsie Realty Company, on a system of rates which in principle are the reverse of those in general use. The customer may choose arbitrarily any maximum energy consumption, and for this chosen amount of energy he pays 3.5 cents per kw-hr., regardless of the amount used. For all energy over the chosen maximum the customer pays at the rate of 7 cents per kw-hr.

Most of the householders have chosen a 100-kw-hr. maximum, and by watching their meters they try to keep their energy consumptions within that limit. How well they succeed in this effort is shown by the accompanying table setting forth data for five months taken from the bills of twenty-six customers. The grand average of the energy consumption of all customers is 97 kw-hr., showing that, taken as a whole, the bills of these twenty-six customers averaged only 3 kw-hr. less than the assumed maximum of the majority. In the list are a few families who have assumed a 150-kw-hr. maximum, but these are so few as to have little effect on the general average.

TOTAL ENERGY CONSUMPTION IN WILDWOOD HOUSEHOLDS USING ELECTRICITY FOR COOKING

Customer Number	Nov., Kw-hr.	Oct., Kw-hr.	Sept., Kw-hr.	Aug., Kw-hr.	July, Kw-hr.	Total Five Months, Kw-hr.	Average Five Months, Kw-hr.
1	197	32	119	10	10	368	74
2	100	107	87	95	108	497	99
3	100	85	88	77	105	455	91
4	68	....	....	....	....	68	68
5	100	99	100	100	91	490	98
6	175	143	138	106	114	676	135
7	126	159	100	105	100	590	118
8	100	96	100	97	78	471	94
9	113	74	89	82	71	429	86
10	100	74	97	100	97	468	94
11	98	82	71	70	100	421	84
12	91	43	....	....	....	134	67
13	28	85	77	96	96	382	76
14	91	....	....	....	....	91	91
15	144	129	126	122	125	646	129
16	75	73	97	100	91	436	87
17	107	101	98	118	96	519	104
18	105	93	97	100	89	484	97
19	170	155	179	141	100	745	149
20	49	100	35	104	128	416	83
21	138	53	104	77	83	455	91
22	245	199	163	254	221	1082	216
23	97	86	77	98	100	438	92
24	....	58	....	....	....	58	58
25	....	....	62	100	93	255	85
26	....	....	....	18	101	119	60
Grand total of average bills							2526
Grand average							97

Since it has been seen that the tendency of the electric-service customers is to purchase energy only at the lower rate, Mr. R. B. Wiltsie, who is in charge of this project, has filed a petition with the Ohio commission asking permission to reduce the secondary rate from 7 cents per kw-hr. to 5 cents per kw-hr. This step, it is hoped, will still further stimulate the use of electrical energy in this model and modern suburb, a portion of which is shown in the accompanying illustration.

In addition to the electric stoves which are sold with every house, the residents of Wildwood generally use irons, vacuum cleaners, percolators, toasters and curling irons, and some have placed ornamental lighting outfits in their yards for use at such functions as lawn parties and the like. One of these installations, which has been made a permanent decoration, consists of seventy-five 15-watt lamps.

NEW HOUSES IN WILDWOOD WHERE ELECTRIC COOKING IS USED EXCLUSIVELY

Service Panel Introduces Electricity in Many Homes

Where people cannot afford to have their houses wired for electric service, or when they doubt that electricity can be used at reasonable expense, electric-service companies may conduct successful new-business campaigns by following the example of the Lockport (N. Y.) Light, Heat & Power Company. Shown herewith is one of the announcements made by this company to introduce electricity into homes without any expense to the consumer for wiring. In this advertisement the company points out that residents of Lockport may have electric-service connections in their kitchens or dining-rooms with the use of a bracket fixture and electric flatiron by paying only $5 cash or $6 in deferred payments of 50 cents a month. This low price is made possible by furnishing the service switch, fuses, meter, service receptacles and lamp fixture already mounted on a single panelboard, which can be installed quickly near the service entrance. These panelboard equipments were assembled by a local contractor at an expense to the company of $2 for a board, $1.78 for the

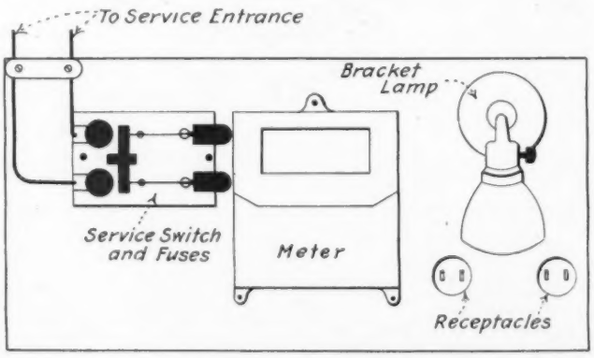


FIG. 1—SERVICE PANEL FOR TEMPORARY INSTALLATION

iron, 55 cents for labor, 10 cents for cartage and 60 cents for material, making a total unit expense of $5.23.

Ten days after the campaign started fifty-four panels were contracted for, twenty-five of which were paid for in full, the others being accepted under the deferred-payment plan. This method served to introduce electricity into a number of homes which were visited about two months later to secure contracts for more extensive and permanent wiring. When a contract was closed for replacing the temporary installation with permanent wiring the consumer was credited with $4 for the return of the board, being allowed to keep the flatiron. Mr. F. M. Houston, commercial manager of the company, has expressed himself as being highly pleased with this method of introducing electric service, and believes that it is especially effective where

TRY
ELECTRICITY
WITHOUT
WIRING COST
Here is a wonderful plan by which you may enjoy the comforts of electricity for lighting and doing the houshold tasks. It puts electricity at your service immediately without cost.
A handsome panel board containing all the elements of a complete house-wiring installation. It has switch, meter, lamp bracket and two attachment plugs; also an electric iron, all mounted compactly on a well-finished hardwood back.
The lamp bracket will furnish light for one room, and the attachment plugs can be used for an electric iron, vacuum cleaner, or any of the wonderful electric appliances.
On receipt of your application, we will install this panel complete—do all necessary wiring and run our service to your house. In addition, we will deliver that greatest of home comforts—
AN ELECTRIC IRON!
Thus you have electricity as your servant—willing, untiring, cheap, and have not spent one cent for installation.
You pay us fifty cents per month for one year, in addition to your monthly bill. At the end of that time, panel and flatiron becomes your property.
Write or call us on the phone and begin a new era of housekeeping. Phones Bell 393 Home 58
Lockport Light, Heat & Power Co.

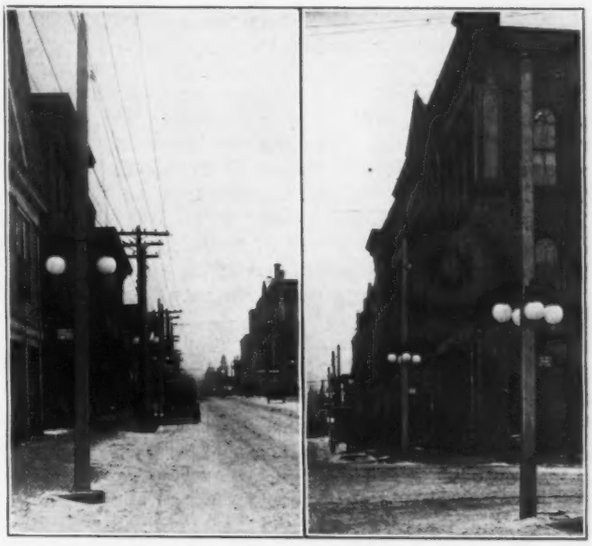
FIG. 2—ANNOUNCEMENT OF INEXPENSIVE SERVICE CONNECTION

prospective consumers require conviction of the advantages of electricity or are unable to afford the first cost of installation.

Combined Concrete Poles and Lighting Standards

The city of Salem, Ohio, recently spent $20,000 to install and place in operation a modern street-lighting system for both the residence and business districts. As it stands to-day, the system consists of 750 concrete poles carrying 850 gas-filled tungsten lamps.

The poles range from 35 ft. to 45 ft. in height, are 6 in. square at the top, and are spaced about 100 ft. apart in the business district and from 175 ft. to 200 ft. apart in the residence section. Although the poles were made by the Pittsburgh Concrete Pole Company, they were molded in Salem. The entire task of manufacturing these standards occupied about six months. Except in a few instances where automobiles have collided with the poles, they have shown themselves able to withstand all strains imposed upon them. Automobile drivers who demolish the standards are required to pay



FIGS. 1 AND 2—CONCRETE POLES AND GAS-FILLED LAMP FIXTURES IN DOWNTOWN DISTRICT IN SALEM

the cost of replacement, which generally amounts to $15 or $20 a pole.

The single wire for the series circuit is supported on iron brackets near the top of the poles, and in places at which lighting units are to be used double-pin brackets are employed to provide for the double dead end. The "feed-in" wires are installed without intermediate supports between these double brackets and the hoods of the lamps themselves. The lamps, which are of the 100-cp gas-filled type, are arranged on four 6.6-amp circuits emanating from the city's transformers and switchboard.

In the down-town streets the lamps are placed in

FIG. 3—TYPICAL LIGHTING IN RESIDENTIAL DISTRICT

diffusing globes, and except at the corners two-lamp brackets are suspended from each pole. On the corner poles four-lamp clusters are used, the series circuit passing unconcealed from lamp to lamp and rising from the first and last units of the series to the pole-stop bracket. Energy for operating the lamps is purchased from the Salem Electric Light & Power Company, of which Mr. D. L. Davis is treasurer and manager. According to data collected by Mr. I. N. Russel, director of public service for the city of Salem, it costs, including the charge for energy and lamp renewals, about $400 a month to maintain and operate this system on an all-night schedule.

A Signed Order for Every Job

The value of having a signed order for every job, no matter how small, is realized by a progressive electrical contractor of St. Paul, Minn., and no work is started until the customer's signature is safely on the dotted line for further reference and for protection against misunderstandings. When calls for repair work are received over the telephone, the man going out on the job takes an order blank with him and obtains the signature of the customer before beginning work. Where

THE ELECTRIC CONSTRUCTION COMPANY

Order No.....

You are hereby authorized to do the following construction to be billed to.....

for which we agree to pay the contract sum of $.....

on time and material basis.

Description of work

.....

.....

.....

.....

Order taken by..... Signed.....

ORDER BLANK OF ST. PAUL COMPANY

extras are ordered by the owner after the initial order the workmen obtain signed authority for these additions, and the slips are pinned onto the original order blank. Reproduced herewith is the form of order used by the salesmen and field men.

Cost of Street Lighting with Nitrogen Lamps

A comparison of the cost of street lighting on various schedules with nitrogen-filled lamps was recently submitted at Spencer, Mass., by Mr. William Plattner, consulting engineer, Boston, in connection with a report upon the electrical service of the Spencer Gas Company. At present the town is lighted by arc lamps, but in the investigation a study was made of the possible application of nitrogen-filled units to the local service. The figures are given herewith in view of their applicability to small-town service on schedules of different length. Spencer is a manufacturing town of about 7000 population about 12 miles southwest of Worcester, and electrical energy for local use is supplied to the gas company at 3.5 cents per kw-hr. by the Central Massachusetts Electric Company, of Palmer.

TABLE I—FIXED CHARGES

Interest on street-lighting investment required, 6 per cent	$889.80
Depreciation, 5 per cent	741.50
Insurance, liability, etc., 2 per cent	296.60
Taxes, town, corporation, state, etc., 2 per cent	296.60
Total annual fixed charges, the same for all schedules	$2,224.50

The total investment required for nitrogen street lighting was estimated by Mr. Plattner at $14,830, representing an outlay of $6,348 in distributing lines and an equipment of 220 60-cp, 40.2-watt type C nitrogen lamps and fifty 80-cp, 52.8-watt lamps of the same type.

TABLE II—SCHEDULE OF STREET-LIGHTING COSTS

	Dusk-Midnight	Dusk-Midnight, 5:30 A.M.-Dawn	All Night
Hours per year	2,000	2,500	3,600
Management, clerical, superintendence	$296.60	$296.60	$296.60
Lamp renewals, repairs, inspection:			
$2.22 60-cp; $2.45 80-cp	604.24	.....	.....
$2.22 60-cp; $2.45 80-cp plus 25 per cent	.....	$755.30	.....
$3.50 60-cp; $3.80 80-cp	.....	.....	$960.00
Maintenance of pole line, wires, etc.	$296.60	$296.60	$296.60
Kilowatt-hours of electrical energy	24,999	31,806	45,516
Cost of electricity at 3½ cents	$874.98	$1,113.21	$1,593.26
Total operating cost	$2,072.42	$2,461.71	$3,146.46
Fixed charges	$2,224.50	$2,224.50	$2,224.50
Total yearly cost	$4,296.92	$4,686.21	$5,370.96
Lamp price necessary per year, 60 cp	$15.75	$17.00	$19.50
Lamp price necessary per year, 80 cp	$16.60	$18.50	$22.00

Billing for Labor and Material Only

After a bitter experience with itemized accounts for electrical work, which customers bickered over and contested until the contractor's hair grew gray, one electrical contractor doing business in a city of 100,000 has now adopted the practice of billing for "labor" and "material" only on all statements totaling less than $10. The result has been a reduction of 75 per cent in the "kicks" received, for most of these objections came from customers who had small jobs done. Although very few customers now question the figures as set down in the bill, when they do the contractor can refer to his own books and answer any request for the itemized figures which may accompany a protest. Most of the complaints made were with respect to labor items, the principal topic of contention being the length of time required by the workman to complete the customer's job. But by eliminating the figures from his bill he has shut off the opportunity for most of the complaints formerly registered, while on the other hand the customers seem equally well satisfied with the results and indeed pay their bills more cheerfully than ever.

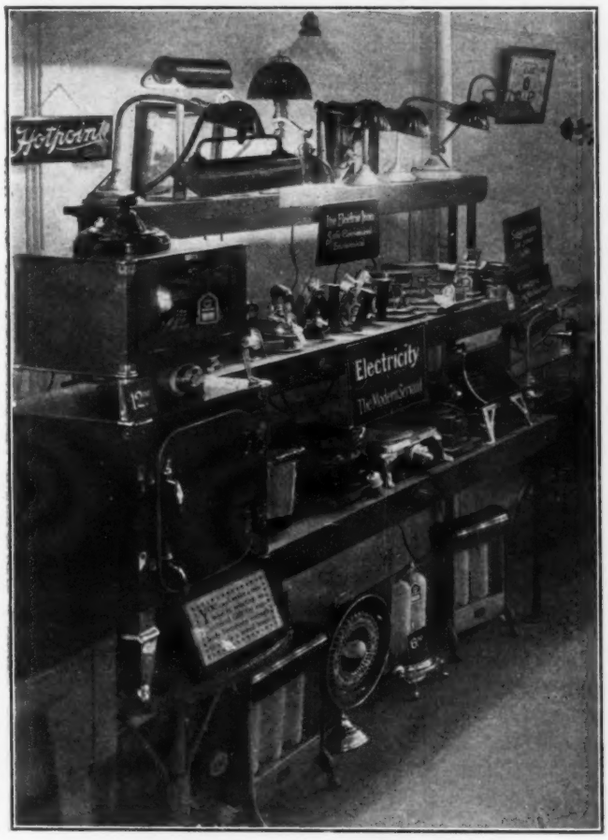
Electric Sign Regulations at Boston

Metropolitan Fire Prevention Commissioner John A. O'Keefe, of Boston, Mass., has issued a set of regulations covering the installation of electric signs and other advertising devices on buildings, following a hearing attended by representatives of central stations and of municipal fire departments in the Greater Boston district. The rules provide for the approval of all roof signs by local building inspectors, subject to appeal to the fire prevention commissioner, for the ballasting of signs in such manner that they will not fall into the street in case the supports are destroyed, and for a minimum clearance of 3 ft. between the ends of signs and the outside walls of buildings, with a minimum roof clearance of 4 ft. Wiring is to be in accordance with the National Electrical Code, and the provision objected to by Mr. W. H. Blood, Jr., of Boston, insurance expert

of the National Electric Light Association, that separate switches should be provided at or near building entrances for roof signs, has been stricken out by the commissioner.

Let Shoppers Handle the Appliances Displayed

If you want to sell electrical devices, place them where the shoppers can handle them. This is the opinion of Mr. Joseph V. Guilfoyle, manager of the appliance-sales department of the United Electric Light & Power Company, New York City. In this company's appliance department irons, curling-iron heaters, hotplates and similar small devices are exhibited on the rack shown in the accompanying illustration. At the rear of the rack are service outlets to which the devices may be readily connected for demonstrating purposes.



DISPLAY RACK FOR ELECTRIC APPLIANCES

Only one unit of each type is displayed in the showroom, as orders are filled from stock. Attached to each device is a price tag written so that shoppers can read it. Displayed in this manner, purchasers are shown that uniform prices are offered to all and can convince themselves that the devices are satisfactory and as represented.

The Public's Investment in Utilizing Utility Service

Within eighteen months after the present Louisville (Ky.) Gas & Electric Company had been formed by the consolidation of the former competing utilities the number of users of electricity in the Falls City had increased by 6015, or 35 per cent, the gain in connected load being 8642 kw, or 24 per cent.

A fact often lost sight of in the electric-lighting industry is that a large investment on the part of the public is necessary in order to receive and apply utility service. At Louisville, for example, the records at the city hall show that wiring permits covering work valued at a total of $2,281,477 have been issued during the five years ended Sept. 1, 1914.

RECORD OF WIRING PERMITS IN LOUISVILLE

Year Ended Sept. 1	Number of Permits	Value of Work
1910	2,175	$264,279
1911	2,570	447,819
1912	3,469	526,368
1913	4,726	537,920
1914	6,042	505,091

The last year cited exhibited a large increase in the number of permits but a slight falling off in the value of the total expenditure, indicating that there were fewer big jobs and more small ones, such as the wiring of cottages, which the company, in co-operation with local wiring contractors, made a special object.

Shutter Background for Large Electric Roof Sign

As electric signs were installed on one building behind another near the public square of an Eastern city, the lamps of the signs at the rear showed through the open spaces of the nearer outline displays, rendering the latter illegible. An opaque background was therefore erected by the owners of the nearer sign, but in order that the added "sail area" might not endanger the roof structure during the high winds to which the region is subject, this background was made up of metal shutters painted black and hinged along their horizontal middle axes so that at the approach of a windstorm the plates can all be turned into the horizontal plane, opposing little added resistance to air movement. On fine evenings, when the crowds are out on the streets below, the shutters are set in their perpendicular position, obscuring displays at the rear and making the nearer sign more easily legible.

Dayton Company Supplies Service to Government Building

The new Federal Building being erected by the United States government at Dayton, Ohio, is being supplied with both electric and heating service by the Dayton Power & Light Company. The post office will occupy the greater part of the building, the remainder being taken up by court rooms and the offices of government employees. Electrically this building represents to the central station a connected load of 35 kw in lighting and 82.75 hp in motors. The table herewith shows to what uses the motors have been put.

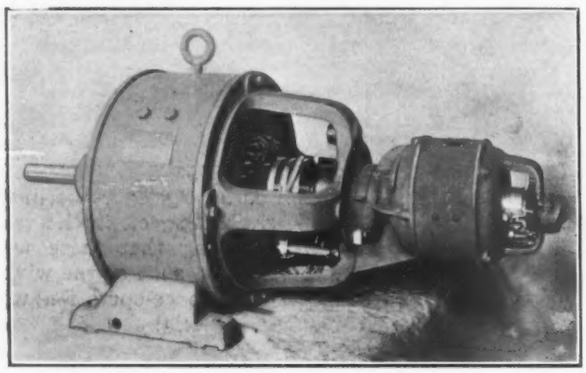
MOTOR APPLICATIONS IN GOVERNMENT BUILDING

Number	Application	Rating in Hp
2	Elevators (each, 25 hp)	50.00
2	Lifts (each, 5 hp)	10.00
1	Ventilating fan	10.00
1	Vacuum pump	5.00
1	Air washer	3.00
1	Sump pump	1.00
1	Thermal control equipment	1.00
1	Circulating-water pump	1.00
1	Ice machine for drinking water	0.75
1	Air pump	1.00
Total		82.75

NEW APPARATUS AND APPLIANCES

Small Belted Alternator

For use in small plants the alternating-current generator shown herewith has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is equipped with a directly connected exciter as shown, making a very compact unit and securing, it is claimed, reliability and independence of operation. The generator is rated at 20 kva for three-phase operation or 14 kva for single-phase operation. It operates at a frequency of sixty cycles at a speed of 1800 r.p.m. Machines are being made to give pressures of 120 volts, 240 volts, 480 volts or 600 volts as desired.



THREE-PHASE, 240-VOLT BELTED ALTERNATOR

Electric Shop Trucks

In Fig. 1 is shown a 3-ton electric tractor and in Fig. 2 a 3-ton trailer recently built by the Waverley Company, Indianapolis, Ind., for the repair shop of the United States Navy Yard at Bremerton, on Puget Sound, Washington. Both tractor and trailer are designed for conveying plates and angle irons from places of storage to the machines and from machine to machine. The construction of both cars is very substantial, wheels, axle frames and turntables being of heavy steel. The wheels are equipped with 24-in. solid tires. The tractor is provided with a structural-steel bumper which is braced for protecting it from head-end collisions. The wheelbase of the tractor is 66 in., and the platform of the car is 5 ft. by 11 ft., the principal overhang being in front of the front axle. The driver's seat is offset from the body of the tractor so that the entire surface of the platform can be utilized for loading. Energy for operating the tractor is obtained from a thirty-cell, twenty-one-plate lead battery, and a mileage of 30 miles on a single charge can be obtained. With both cars fully loaded a speed of 5.5 miles an hour is developed. Mounted on the platform of each car is a turntable 5 ft. 2 in. in diameter running on rollers and operated by hand spikes for the quick and convenient unloading of the heavy plates or beams it is designed to carry. A single motor is used, and the power is transmitted to the rear axle by means of worm-gear-shaft drive. A 50-ft. cable connects the trailer to the tractor, giving ample room, it is declared, for the longest beam that could be carried on an ordinary flat car.

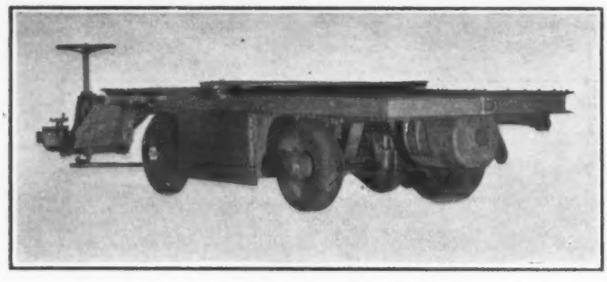


FIG. 1—SHOP-TRUCK TRACTOR

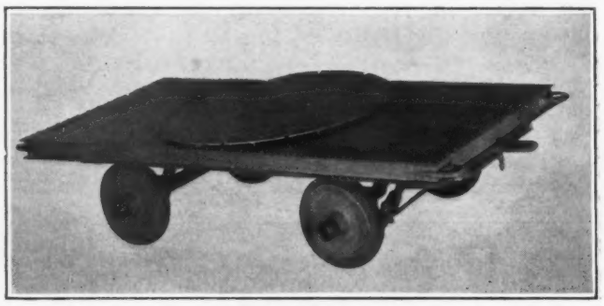


FIG. 2—SHOP-TRUCK TRAILER

Motor-Driven Fly Catcher

A motor-driven fly catcher is being marketed by the Vogel Products Manufacturing Company, 1616 Chestnut Street, St. Louis, Mo., by which flies and other insects which approach the suction intake of the machine are whirled through the blades of a powerful blower and deposited in a steel cage. Sweet material placed near the opening attracts the flies in the daytime, and at night an electric lamp may be used to bring the insects within range of the suction. The machine weighs 30 lb. and is driven by a 1/30-hp motor. The cost to operate it is, according to the manufacturer, about equivalent to that of burning a 16-cp lamp. Several styles of mouthpieces are available, or pipe extensions may be installed so that the blower mechanism can be placed at some distance from the intake.

MOTOR-DRIVEN FLY-CATCHING MACHINE

A 100,000-Volt Switch

In Fig. 1 is shown a 100,000-volt switch recently developed by the K-P-F Electric Company, 37 Stevenson Street, San Francisco, Cal., and designed particularly for use with transmission-line towers. The switch is

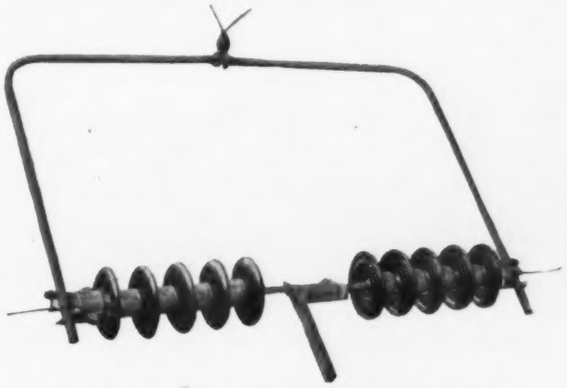


FIG. 1—THREE-UNIT, 100,000-VOLT SWITCH

bolted to the ends of the tower arms, and the break in opening it is made in a vertical direction. No special construction is required, and there is ample clearance, it is claimed, between all live parts and ground. Switches of this type are being made of from one to seven insulator units, depending on the voltage. In ordinary work the line is dead-ended directly to the switch insulator, but in high-voltage transmission service it is advisable to use separate dead ends as shown in the illustration. In Fig. 2 sectionalizing switches of the above type are shown in use on the main 100,000-volt tower line of the Great Western Power Company from Big Bend, on the Feather River, to Oakland, Cal.

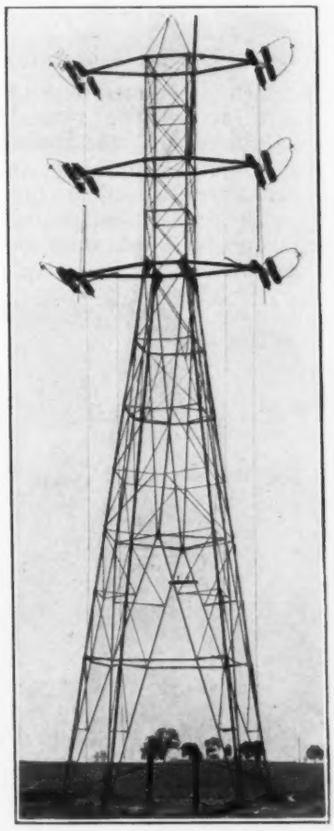
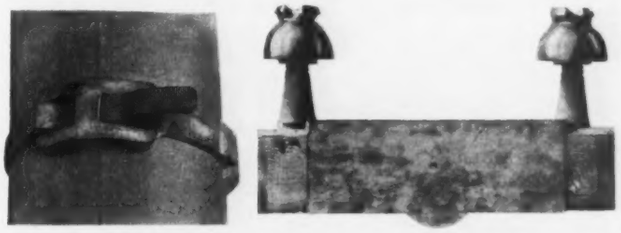


FIG. 2—100,000-VOLT SWITCHES ON LINE OF WESTERN POWER COMPANY

Improvements in Linemen's Protectors

The active demand by operating electric light and power companies for a lineman's shield which will not pull open under any conditions while it is in use on a live conductor has induced the Linemen Protector Company, of Detroit, Mich., to develop a shield made with an attachment for holding the edges snugly closed.



FIGS. 1 AND 2—DETAILED VIEWS OF SHIELD FASTENER AND CROSS-ARM PROTECTOR

This lock-strap attachment, as it is called, consists of a single 0.25-in. piece of solid rubber fashioned into a strap and clasp. When the toe of the strap is pulled through the rubber clasp a lug on the strap engages the cross-bar of the clasp and holds the shield closed. As is shown in Fig. 1, the toe of each strap carries two lugs so that the shield may be buckled loosely or closely about a conductor.

Two of the rubber straps are attached to each shield in such a manner that with ordinary usage they will never become detached from the shields. Should one of the straps become broken, however, a little vaseline or soap rubbed into the keeper which holds them will lubricate the passage sufficiently to allow the retaining lugs to slip through the rubber keeper and the damaged strap to be removed from the shield. When the old strap is taken off the shield a new one can be easily pulled into place. A shield covering an ice-coated con-

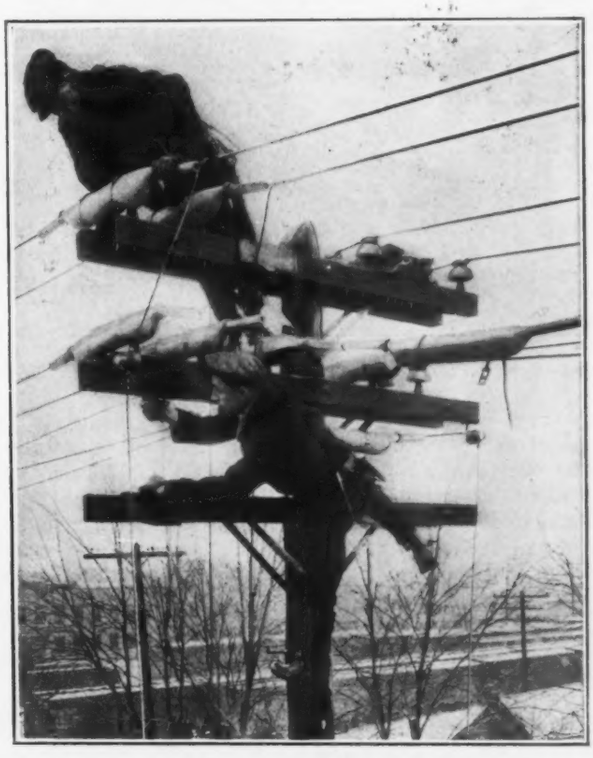


FIG. 3—USING LINEMAN'S SHIELDS ON AN ICE-COVERED POLE

ductor is shown in Fig. 3 with one of the straps buckled and the other hanging unfastened but still securely attached to the shield at its outer end. The rubber rings which were formerly used to clasp the end pieces of the shields about the wires are still used in conjunction with the improved strap-lock fasteners.

Another safety device which the Linemen Protector Company is now placing on the market is the cross-arm protector shown in Fig. 2. This 0.5-in. sheet of solid rubber, designed to slip over a cross-arm and rest securely between two pins, is being made to eliminate the necessity of using the shields as foot or knee insulators. An excellent example of the manner in which cross-arm protectors are employed is presented in Fig. 4. The man working on the lower cross-arm is sitting on

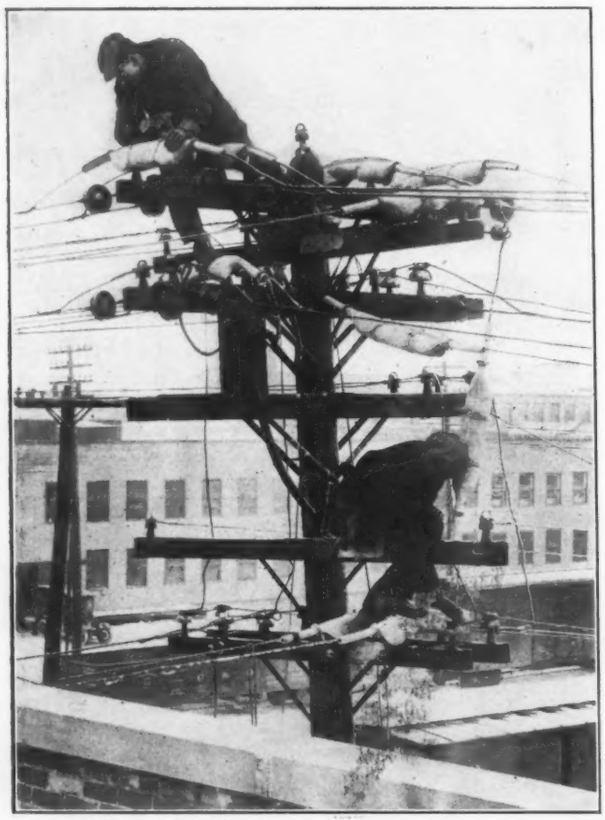
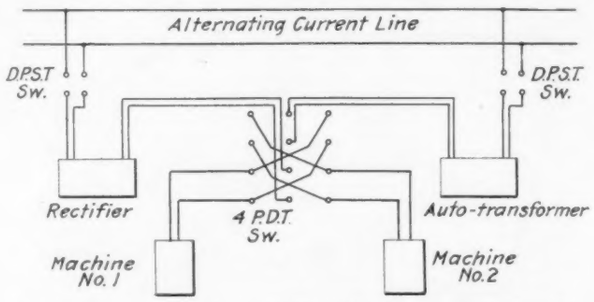


FIG. 4—SHIELDS AND CROSS-ARM PROTECTORS USED BY MEN IN CRAMPED QUARTERS

one of the devices and is resting his foot on another. The man at the top of the pole, in a veritable mesh of 2300-volt conductors, is resting one foot and both of his knees upon protectors of this type. The cross-arm protectors, like the lineman's shields, are made of stock which contains no reclaimed rubber, because in the latter a trace of metal is said to be always present.

Apparatus for Changing Motion-Picture Reels

In the accompanying illustration is shown a diagram of connections which illustrate a method recently devised for changing reels without interruption on the screen. The equipment used in this method consists of a Westinghouse type AL rectifier designed for motion-picture work, an auto-transformer and a four-pole, double-throw switch. When the No. 1 machine is operating the switch is thrown to the left. About one minute before the end of the reel is reached the operator throws the switch to the right, operating the arc on machine No. 2 through the rectifier. Machine No. 1 is then connected to the alternating-current circuit through the auto-transformer until the operation of the reel on No. 1 machine is completed. When it is time to operate the No. 2 machine, the electrodes are burning at their proper brilliancy and are ready for the second

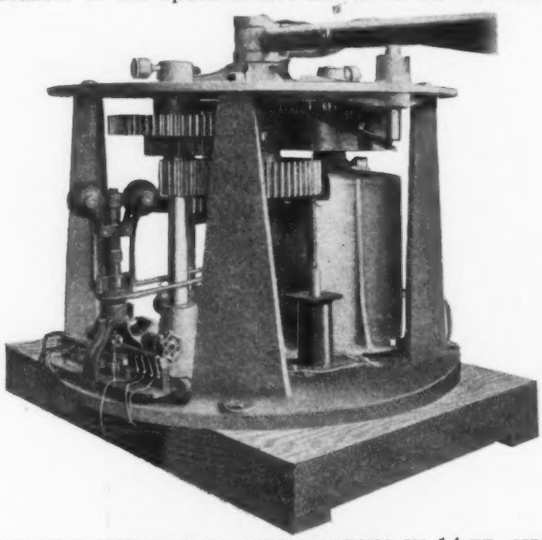


APPARATUS FOR CHANGING MOTION-PICTURE REELS

reel. The process is repeated toward the end of the second reel on the No. 2 machine. The procedure may be reversed if desired—that is, by starting the No. 2 machine on alternating current and later throwing on the direct current. However, the first-mentioned method will be found more satisfactory, it is declared, as it takes a few seconds for the direct-current energy to consume the electrodes properly while the alternating current causes them to splutter under all conditions, but less when they are already heated by the direct-current energy.

Horse-Driven Generator

A generator which is operated by a horse moving in a 14-ft. circle at a rate of about two miles an hour is being placed on the market by the Electric Horsepower Company, 906 Elm Street, Cincinnati, Ohio. The generator is a 40-volt direct-current machine and is rated at 0.75 kw. In case the horse should slacken his speed, an electric bell rings as a warning, and immediately thereafter if the speed is not increased an electrically

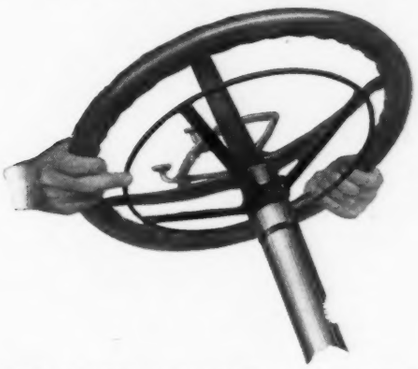


GENERATOR OPERATED BY HORSE MOVING IN 14-FT. CIRCLE

operated whip strikes him on the back. The operation of the bell and the whip is obtained by means of a circuit-closing device moved by the stem of a ball governor. The rating of the battery used with the generator is 16 amp-hr., and when charged it contains enough energy to operate a 16-cp tungsten lamp three hours a day for forty days.

Automobile Ring-Type Horn Switch

An automobile horn switch which can be attached to the steering post and can be used with either a single-wiring or a double-wiring system is being made by W. P. Seng, 1450 Dayton Street, Chicago, Ill. The switch ring is of spring steel and may be operated by a finger



RING-TYPE SWITCH ATTACHED TO STEERING WHEEL

of either hand, as shown in the accompanying illustration, without removing the hand from the steering wheel. All contact points are of German silver. The wire is brought up along the steering post through conduit. In installing the switch a screw is removed from the ring and another from the hub band. The ring is then pulled apart and slipped over the steering post. Fiber bushings are next sprung over the post and slipped underneath the hub. The switch ring is placed about 0.5 in. below the spokes in the steering wheel.

Vibrators for Ignition Apparatus of Automobiles

In the accompanying illustration is shown a vibrating set inclosed in a pressed-steel case, which is designed particularly for use with ignition sets on automobiles. The total weight is only 2 lb. So-called indestructible

VIBRATOR FOR AUTOMOBILE IGNITION SET

spark points are utilized with this vibrating set. They are of a special material which is declared to be harder than platinum. For No. 9 wire the points are 10/64 in. wide; for No. 12 wire they are 7/64 in. wide. The master "vibrator," as it is called, is especially well adapted for use with ignition sets having two coils, four coils or six coils. The device is being placed on the market by the New Era Spring & Specialty Company, 870 Woodward Avenue, Detroit, Mich.

Electrically Operated Tools

A motor-driven device for die sinking, drilling, buffing, grinding and driving screws is shown in Fig. 1. The device is mounted on a pedestal as shown and is

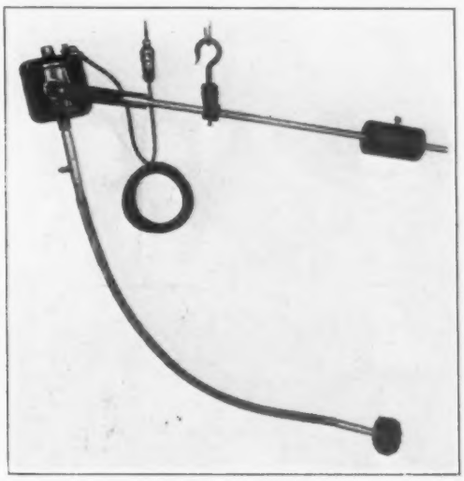


FIG. 1—SUSPENDED ELECTRICALLY OPERATED TOOL

operated by either a 110-volt or 220-volt alternating-current motor or 110-volt or 220-volt direct-current machine. The tool shown in Fig. 2 is designed to be sus-

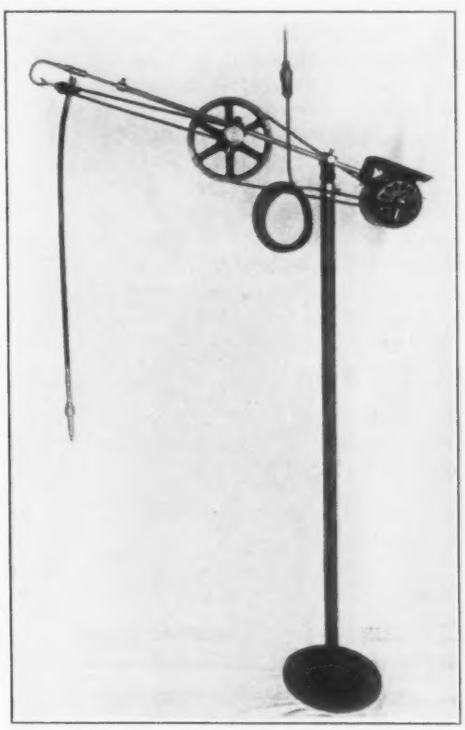


FIG. 2—MOTOR-DRIVEN TOOL ON PEDESTAL

pended and can be used as a drill, buffer or grinder. The motor for this device is directly connected to a flexible shaft. The device operates at a speed of 3400 r.p.m. and may be used with a 110-volt or 220-volt

alternating-current motor or 110-volt or 220-volt direct-current motor. The devices described above are being made by the Stow Manufacturing Company, Binghamton, N. Y.

Wagon with Two-Motor Concentric-Gear Drive

A 0.5-ton electric truck with two motors and concentric-gear drive has recently been developed by the Commercial Truck Company of America, Philadelphia, Pa. The construction of the wagon is similar to that of 1-ton

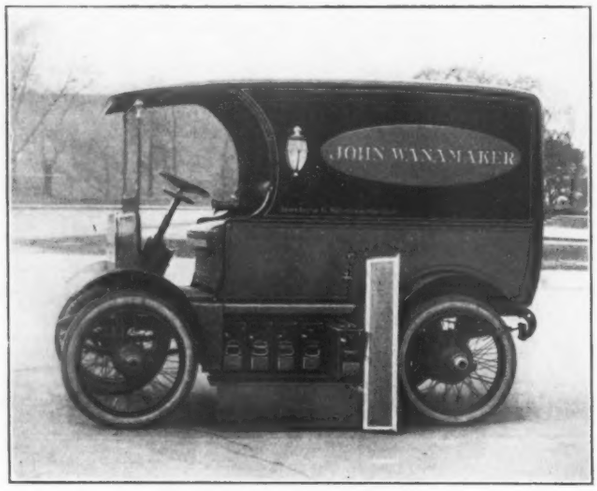


FIG. 1—1000-LB. TRUCK WITH WIRE WHEELS AND PNEUMATIC TIRES

and 2-ton trucks made by the above company. Two General Electric motors are employed to operate the truck. The battery consists either of forty-two lead cells or sixty Edison cells; for the former the pressure is 85 volts and for the latter 60 volts, the current in each case being 12 amp and 17 amp. A mileage of 40 miles to 60 miles is developed, depending on the battery equipment. The gears are completely inclosed and run in oil, double reduction being obtained. The front axle has a rectangular-box section. The rear axle is of the full-floating type and has a double-channel section. The axle bearings are of the taper-roller type and those of the motor of the annular-ball type. The frame is of channel irons and is trussed and thoroughly braced with

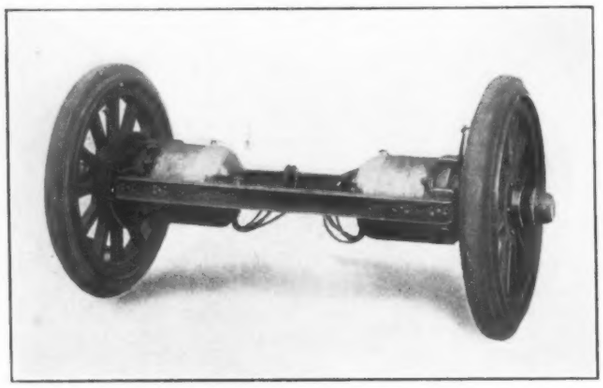


FIG. 2—ARRANGEMENT OF MOTORS

gussets at the corners. A continuous torque-type controller is employed which is at the base of the steering column. There are four points for forward speeds and two points for reverse speed. The front tires are 2.5 in. by 36 in. and the rear tires are 3 in. by 36 in. The brakes are of the internal expanding type.

In Fig. 1 is shown a truck of the above type built for John Wanamaker of Philadelphia for use by the jewelers and silversmiths' department. Although this truck is equipped with wire wheels and pneumatic tires, use is generally made of solid tires and wheels similar to those shown in Fig. 2. Fig. 3 illustrates the arrangement of

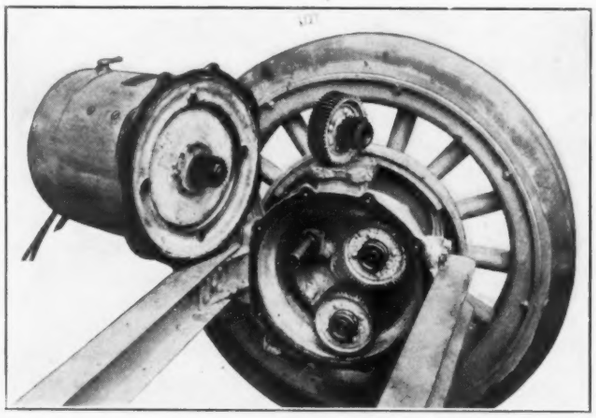


FIG. 3—ARRANGEMENT OF GEARS

gears and the method of connecting the motor to the wheel.

According to the manufacturers, the following advantages belong to the two-motor concentric-gear type of electric trucks: It is well adapted for climbing hills; traction chains for slippery and snowy roads are unnecessary; the arrangement of motors is simple; in case of trouble in one motor it can be disconnected and the truck may be operated temporarily on the other motor.

Adjustable Portable Lamp

A lamp which can be attached to a variety of objects or can be mounted on a table, chair, piano, etc., and which is adjustable, has recently been placed on the market by the Aladdin Lamp Corporation, 111 Broadway, New York. The lamp is equipped with 10 ft. of cord which winds into the base and can be let out to any length desired. It is provided with a Cutler-Hammer

ADJUSTABLE LAMP

push-button socket and an adjustable and detachable shade. The shade is so designed that it will fit any size or style of globe and can be turned to any angle so as to concentrate the light in the direction desired. The inside of the shade is coated with satin-finished aluminum. Use is made of an automatic felt-covered clamp

for fastening the lamp to a desk, chair, dressing table, bedpost, etc. When not extended the clamp rests flatly on the base of the lamp. A rubber suction cup is used for attaching the lamp to any smooth, polished, nonporous surface. The joint is so arranged that, no matter to what extent the neck is tilted, there is no exposure of the cord. When standing upright the lamp is 12.5 in. high; the diameter of the base is 4.5 in., and the lamp weighs 1.5 lb. The lamp is finished in satin-polished brass or nickel as desired. An auxiliary clamp is employed where it is desired to attach the lamp to a table, desk, shelf or other object too large for the automatic clamp to fit properly.

Flashlamp Shaped Like Fountain Pen

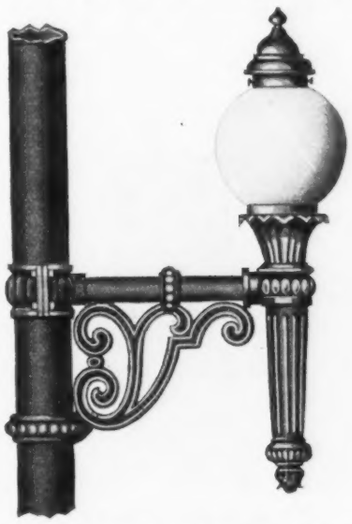
A flashlamp which is similar to a "banker's" fountain pen in size and appearance has just been placed on the market by the American Eveready Works, 308 Hudson Street, New York. The light can be either flashed or

"FOUNTAIN-PEN" FLASHLAMP

turned on continuously as desired, and the lamp may be laid down while burning, so that both hands are free to work. The device is 4.75 in. long, 0.75 in. in diameter, and weighs 1.5 oz. It is provided with a clip so that it can be securely carried in the vest pocket.

Bracket for Nitrogen-Filled Lamps

A bracket designed especially for supporting high-efficiency incandescent lamps has recently been placed on the market by the Electric Railway Equipment Company, Cincinnati, Ohio. The bracket is made in two styles, either of which can be arranged to take lamps in



BRACKET ATTACHED TO STREET-RAILWAY POLE

multiple or series or with a compensator. The socket is so mounted that the height can be adjusted, thereby making it possible to use any size of lamp. With this arrangement the filament of the lamp can be placed in the center of the outer globe. The above company is also making standards particularly designed for nitrogen-filled lamps. The accompanying illustration shows a bracket which is designated by the manufacturers as No. 10,275 and which is attached to a street-railway pole.

Battery-Charging Equipment in Private Garage

In the accompanying illustrations is shown battery-charging apparatus recently installed in the garage of A. B. Hastings & Son, Campello, Mass. Energy is obtained from a single-phase alternating-current circuit,

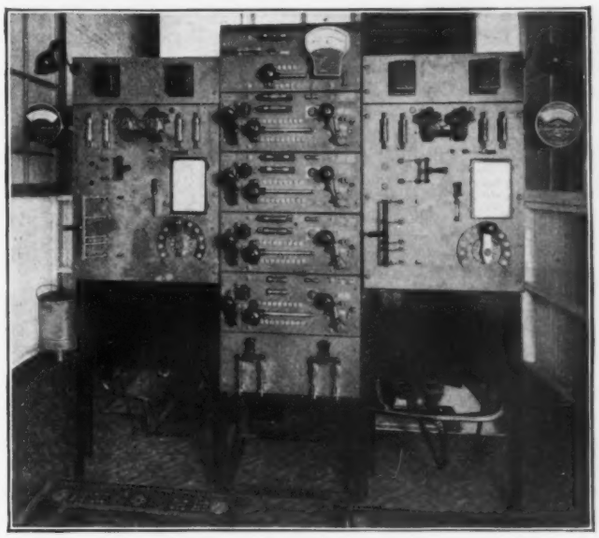


FIG. 1—CHARGING RHEOSTATS AND ROTARY-CONVERTER PANELS

and for changing the alternating current to direct current use is made of two Wagner rotary converters and sectional or unit-type charging rheostats made by the Cutler-Hammer Manufacturing Company, Milwaukee. In Fig. 1 are shown four sectional charging units mounted on the middle frame with a Wagner rotary-

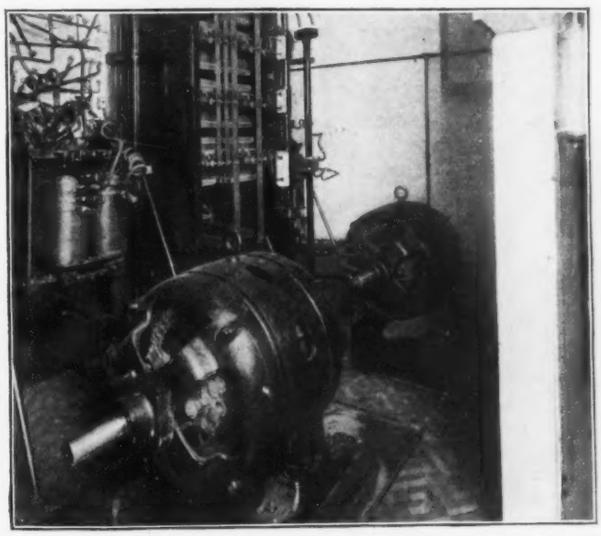
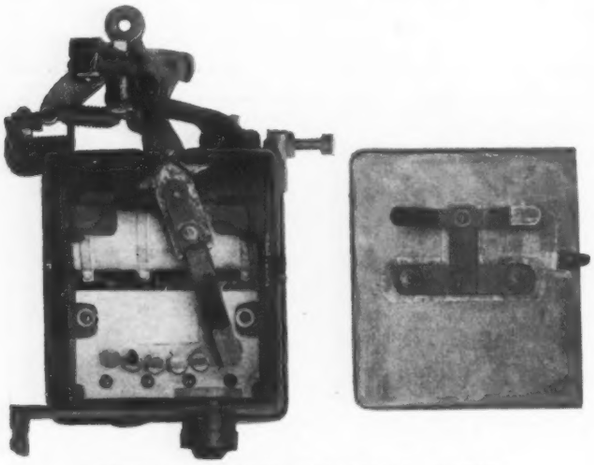


FIG. 2—ROTARY CONVERTERS AND REAR OF CHARGING PANEL

converter panel on each side. The rheostat handles are so arranged that a number of vehicles can be charged at the same time from one location. Fig. 2 illustrates the rotary converters and the rear of the charging panel. The rheostat units and panels were completely wired before being installed.

Controller for Small Motors

A starter and speed regulator for small motors, consisting of a resistance coil with taps connected to brass contact studs which are mounted on a porcelain base and inclosed in a cast-iron cabinet, is being made by M. Taigman, 239 Wooster Street, New York. A lever carrying a carbon contact extends through the side of



SPEED REGULATOR FOR SMALL MOTORS

the box and is operated by a series of levers. Springs are provided for preventing the contacts being left in the running position. A Hubbell plug connector is attached to the frame of the controller, by means of which wire connections are eliminated. The entire mechanism is removable from the cabinet as a unit. When the cover is removed the circuit is automatically opened. When the cover is in position a bridge spring attached to the cover completes the circuit between the terminals.

Automobile Bell

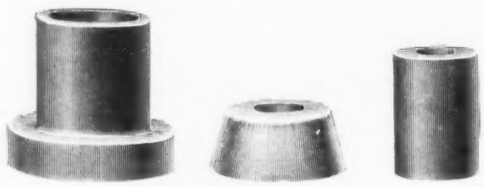
An electric bell which can be mounted on the running board, fender, cowl, dash or radiator cap of an automobile is shown herewith. A tungsten lamp with red-glass lenses is mounted on top of the bell and is fastened to it

ELECTRICALLY OPERATED AUTOMOBILE BELL

by a slot, and a spring holds it in position. The contact points are of platinum and automatically adjustable. The bell is of bell metal, nickel-plated. The outfit includes 12 ft. of wire, a nickel push-button, an upright or a side bracket, and bolt and washers. The bell is made in three sizes. The Trinity Bell Electrical Manufacturing Company manufactures the device.

Lava Insulators

Various types of insulators and bushings of lava or silicate of magnesia are being made by M. Kirchberger & Company, 376 Second Avenue, New York. The insulators are cut from the solid lava, the material being placed in a turning lathe in its original solid state. Sharp lines, straight shoulders and accurate fittings can



INSULATORS OF LAVA

be obtained, it is claimed, with the material. The Crescent insulators, as they are called, can be made in a variety of shapes and models, and they are said to possess high heat-resisting qualities.

"Magic Mirror" as Window Attraction

The Monroe Supply Company, Dexter Building, Chicago, makes a show-window attraction in the form of a "magic mirror" which may be used for advertising or display purposes. When lighted from the front in the usual way the glass presents the appearance of a genuine mirror, no hint of its double function being in evidence. Behind the glass, however, is a lamp controlled by a thermo flasher, and when this lamp is lighted transparencies become visible within the frame of the erstwhile mirror. These may be colored, and of any shape or size desired. When the flasher extinguishes the lamp the transparencies disappear and the glass once more becomes a simple reflecting surface.

Electric Ceiling Lamp

The accompanying illustration shows a battery-operated lamp which can be attached to the ceiling of a porch, closet or pantry or fastened to the wall. It is provided with a long string which is connected to the switch. The lamp will burn continuously on one ordinary dry cell for about forty hours, or if used intermittently from six to twelve months. The device is

BATTERY-OPERATED CEILING LAMP

equipped with a tungsten lamp and a large reflector and lens. The case is waterproof and fireproof.

According to the manufacturer, the Lindstrom Smith Company, 1100 South Wabash Avenue, Chicago, Ill., this battery-operated lamp is meeting with favor even in houses where electrical energy is obtained from central stations.

CURRENT NEWS SECTION

Meeting of Electrical Supply Jobbers

The regular meeting of the Electrical Supply Jobbers' Association held at the Hotel LaSalle, Chicago, Wednesday, Thursday and Friday of this week, rounded out a busy week in Chicago electrical commercial circles, which began on Monday with an important conference of Western Electric Company sales managers, a convention of Westinghouse agent jobbers, and a number of local meetings of agents and salesmen at which selling policies and methods were discussed.

More than seventy-five leading jobbers and their accredited representatives attended the opening executive sessions of the jobbers' national convention. Although all of the meetings, including the joint conference with certain manufacturers on Thursday, were held behind closed doors and were occupied with business routine, reports of committees, etc., the trend of the talk among little groups of jobbers in the hotel lobby indicated that these men are all watching closely the business barometer. Relations with manufacturers and with dealers, the stabilizing of prices in hard times, plans for stimulating trade, concentric-wiring problems, plans for "National Electric Week," and other similar themes, were among the topics discussed.

Wednesday's sessions were occupied with reports of committees. The Atlantic and Central divisions of the association re-elected all fifteen members of the general executive committee, and the standing committees were reappointed. Mr. F. S. Price, of the Pettingell-Andrews Company, Boston, Mass., was chosen chairman of the Atlantic division, and Mr. N. G. Harvey, of the Illinois Electric Company, was made chairman of the Central division.

At the meeting of the executive committee on Wednesday evening Mr. Franklin Overbagh, Chicago, was re-elected general secretary and Mr. T. M. Debevoise was continued as general counsel.

The meeting of Thursday morning was attended by many invited representatives of manufacturers, dealers and other associated supply interests. "The Philosophy and Ethics of Industry" was the subject of an address by Mr. A. F. Sheldon, of the Area (Ill.) School of Business Technology, while the topics of permanent price lists, relations between producer and distributer, relation of turnover to gross profits, uniform accounting, etc., were opened for general discussion.

Representative Adamson on Water-Power Legislation

At the annual meeting of the Georgia Bar Association on March 13 Representative Adamson discussed water-power legislation. He enumerated the reasons why for mechanical purposes it is necessary to have cheap electrical energy. Private capital which would develop all water-powers in navigable streams cannot do so without the consent of the federal government. Mr. Adamson criticised so-called conservationists who pretended great concern for the rights of the people because they said the people were not protected in the regulation of the price and use of energy, which, being strictly translated, meant that the states could not be trusted to regulate their public utilities. Furthermore, they positively refused to acknowledge the obvious fact that every creation of a hydroelectric plant must have a market, and generally the market must be created directly or indirectly by the company itself, which may involve building a factory, a railroad or a city—one, two or all three.

Representative Adamson concluded to ask Georgians to assert their own authority and take advantage of their own opportunities. Under existing law Georgia may be independent of any action of Congress if it wants so to be.

Meeting of the Public Policy Committee

A meeting of the public policy committee of the National Electric Light Association was held at the headquarters in New York on March 11. There were present Messrs. W. W. Freeman, chairman; E. W. Burdett, Henry L. Doherty, C. L. Edgar, Samuel Insull, J. W. Lieb, Samuel Scovil, H. A. Wagner, Arthur Williams, and also the following: President Holton H. Scott, R. S. Hale, I. E. Moultrop and Secretary T. C. Martin. Mr. J. M. Wakeman, general manager of the Society for Electrical Development, Inc., joined the party by request at luncheon.

Mr. Hale reported on the work of his committee on concentric wiring. The matter was discussed at length, and it was the sense of the committee that while it is wise to reduce the cost of wiring as rapidly as practicable, especially as applied to old buildings, great care should be exercised to avoid any lowering of reasonable standards of safety.

The committee considered a letter referred to it by the executive committee recommending that some action be taken regarding the principles involved in the suit started by fire-insurance companies against the Northumberland County Gas & Electric Company, Sunbury, Pa. The letter said that the evidence showed that the electric-lighting company did not own or put in the defective installation in the building in which the fire originated but that it was the property and under the full custody of the owner of the building. The matter was referred to a sub-committee.

The question of the proposed condemnation by the city of Los Angeles of a distributing system was taken up, and after consideration of a statement of the case it was decided to send copies and other available information to members in order that the question may be reviewed carefully from a legal standpoint.

The order of the Public Utilities Commission of the District of Columbia requiring the Potomac Electric Power Company to abrogate certain contracts was considered, and the secretary was instructed to send data regarding it to members for their information.

Mr. Lieb reported for the sub-committee on the American Society of Mechanical Engineers' boiler code, taking up the inspection and license features. Mr. Moultrop made a further statement both as to the technical features and those involved in possible legislation. No action was taken, but the committee was in accord generally with the view expressed by Mr. Lieb that it is not the place of the association to formulate or attempt to influence legislation of this kind but to offer its criti-

cism on any measure which may be submitted to it for consideration.

The subject of the nature and scope of the annual report of the committee was discussed. In recent years the committee has devoted a great deal of attention and space to the duties of companies to the public and employees. This year some attention will be given to the other aspect—the duty of the public to the utilities trying to give service.

At the invitation of the committee, Messrs. Doherty and Wakeman made interesting statements in regard to the work of the Society for Electrical Development, particularly from the central-station point of view. Mr. Wakeman said that the society now includes in its membership 321 central-station companies.

A. I. E. E. Activities

At a meeting of the board of directors of the American Institute of Electrical Engineers held on March 12 the executive committee, which had been empowered to decide upon the place and date of the 1915 convention, reported the selection of Deer Park, Md., from June 29 to July 2.

As a result of the ballot for nominees for filling the offices falling vacant on July 31, 1915, the following were selected from the names offered for selection by the membership: For president, Mr. John J. Carty, New York; for vice-presidents, Messrs. Comfort A. Adams, Cambridge, Mass.; J. Franklin Stevens, Philadelphia, Pa., and William McClellan, New York; for managers, Messrs. John B. Taylor, Schenectady, N. Y.; C. E. Skinner, Pittsburgh, Pa.; F. B. Jewett, New York; Harold Pender, Philadelphia, Pa.; for treasurer, Mr. George A. Hamilton, Elizabeth, N. J. In accordance with the constitution, these nominees will be indicated on the election ballot, which will be mailed to the membership before April 1, together with the names of all members who received not less than 3 per cent of the entire number of nomination votes cast.

Federal Trade Commission at Work

The members of the Federal Trade Commission subscribed to the oath of office in Washington on March 16 and held an organization meeting, immediately electing Mr. Joseph E. Davies, retiring Commissioner of Corporations, as chairman. The 300 attorneys, examiners and other employees of the Bureau of Corporations are now employees of the commission. Dr. Francis H. Walker, who was deputy commissioner of corporations at $3,500, was appointed chief examiner of the commission at $5,000 a year.

It is understood in Washington that Mr. Joseph W. Folk, former Governor of Missouri and former solicitor of the Department of State, who is now counsel to the Interstate Commerce Commission, may be appointed general counsel to the Federal Trade Commission.

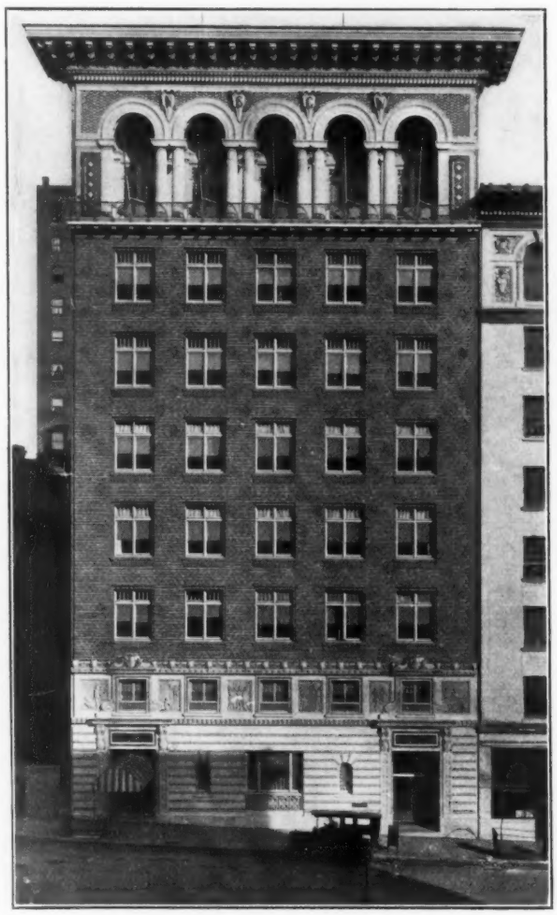
An interesting item of news is that Mr. Davies declined an opportunity just before the last election which, under the political circumstances, would have developed into almost a certainty that he would become United States Senator from Wisconsin. Mr. Davies believes he can be of more service as Federal Trade Commissioner than as Senator.

It is said to be the belief of a leading member of the commission that the idea on which the commission was intended to be based, namely, government control of business, is now on trial. If this idea is not a success, it is said, the administration believes that the people will demand what is called in Washington "the next step," namely, government regulation of business monopolies. As the latter idea is said in Washington to imply socialism, every effort is to be made by members of the commission to popularize their work among business men as well as with the public.

President Wilson has had frequent conferences with the members of the commission, and it is well understood in Washington that whatever ideas the commission carries out are to be approved first by the President. So far as the popularization of the work is concerned, however, it is not expected that this will take the form of frequent public statements. On the contrary, Mr. Davies said to a representative of the ELECTRICAL WORLD in Washington that "the commission will choose to be known by deeds rather than by words." It is, in fact, understood that the meetings will be executive sessions, and that, as the commission is a quasi-judicial body, there will be little more "news" emanating from it, in advance of action, than from the Department of Justice.

N. E. L. A. Convention Building

In the building of the Native Sons of the Golden West illustrated herewith will be held the convention of the National Electric Light Association in San Francisco



SAN FRANCISCO CONVENTION HALL BUILDING

on June 7 to 11. As stated in previous issues of the ELECTRICAL WORLD, the building is at 414 Mason Street, near the St. Francis and other hotels. Of the fourteen large lodge rooms in the building only those needed for the various sections and committees, etc., have been engaged.

The association office and registration headquarters will be in the ground-floor lobby. On this floor is the auditorium. The social hall, which is in the basement, will accommodate 700 or 800 people. The general, technical and commercial sessions will be divided between these two halls under such arrangement as is best in accordance with the program. The public policy meeting will be held in the auditorium, which, with a balcony, will accommodate from 1200 to 1500 people. The sessions of the Accounting Section will be held in a large room in front on the fourth floor. In another room on the same floor will be exhibits of the meter committee, the company section committee and the Accounting or Commercial Section, while a separate room will be provided for the transportation committee. A room on the fifth floor will be reserved for the convention *Daily* and the association stenographic staff.

N. E. L. A. Convention Transportation Plans

The transportation committee of the National Electric Light Association, of which Mr. George W. Elliott is chairman, has issued itineraries for the "red special," "blue special" and "pink special" tours to the convention to be held in San Francisco on June 7 to 11. Many inquiries have been received in regard to the "red special," on which a number of the most prominent men in the industry will make the trip.

An introductory statement to the itineraries calls attention to the opportunity to enjoy many features in connection with the annual convention. It says that the Panama-Pacific Exposition at San Francisco comprises the most beautiful electrically illuminated group of buildings, from both exterior and interior, in the world. The various tours will include every point of scenic grandeur in the Western country, and there will be as many stops as possible at various hydroelectric plants and transmission systems. Mention is also made of the Panama-California Exposition at San Diego.

Water-Powers of New England

At the annual dinner of the General Electric Company to central-station men in New England on March 12 President Henry I. Harriman of the Connecticut River Transmission Company, Boston, Mass., presented a comprehensive paper on New England water-powers. reviewing their early history and sketching the gradual development of more efficient methods of utilization which have found their latest expression in the great hydroelectric systems of to-day. From the little mill of John Alden at Plymouth to the modern hydroelectric plant on the Connecticut or the Deerfield is an immense span, but the speaker traced an interesting development which to-day is represented by over 600,000 hp of water energy.

On the assumption that the average run-off in New England is 18 in., that its area is 60,000 sq. miles and its average elevation above sea level, it is computed that it would be theoretically possible to develop for 3000 hours each year 15,500,000 hp, equivalent to the use of 52,000,000 tons of coal annually. Such a computation is only an interesting mathematical calculation, but it is entirely possible that 10 per cent of this theoretical power may sometime be developed from its streams.

In New England there are eight large rivers with great fall, draining 35,000 sq. miles. These are the Penobscot, with a total fall of 1500 ft.; Kennebec, 1000 ft.; Androscoggin, 2200 ft.; St. Croix, 400 ft.; Saco, 1900 ft.; Merrimac, 269 ft.; Connecticut, 2000 ft., and Housatonic, 900 ft. It is estimated that if these water-powers were properly reconstructed along scientific lines, 200,000 additional hp could be generated. Government estimates are to the effect that there is possible of creation in New England a minimum water-power development of 1,000,000 hp, which by storage and by the utilization of some of the less desirable powers can be ultimately increased to 2,000,000 hp. Maine leads with a maximum possible development of 1,000,000 hp. New England can doubtless utilize all the water-power developed in its limits, on account of its diversified manufactures, there being over 12,000 manufacturing concerns. The speaker anticipated large developments in railroad electrification and industrial power applications under favorable capital conditions.

Mr. Harriman said that in a comparison of operating costs of steam and hydroelectric plants the ultimate effect of a sinking fund on the cost of power is not fully appreciated. Assuming that each kilowatt of machinery in a hydroelectric station (costing $150) produces 4000 kw-hr. a year, and that 1 mill per kw-hr. is put into a sinking fund and reinvested in the 6 per cent securities of the company, the fund thus created will have reduced the cost of the plant from $150 to $100 per kw at the end of the tenth year; at the end of the sixteenth year it will have been lowered to $50, and by the end of the twentieth year the plant will have been entirely paid for, which means that the company will then be able to operate without capital charge and with slight running expenses.

The cost of a water-power plant may be double that of a steam station—say, $100 to $150 per kw against $75 to $100—but the depreciation and maintenance charges expressed in percentages are much less, as there is practically no depreciation or upkeep for water rights, dam or power house, and waterwheels or slow-speed generators depreciate less rapidly than boilers, stokers or high-speed turbines. Interest, maintenance and depreciation on a steam plant may be figured at 15 per cent, compared with 11 per cent on a hydroelectric station. Thus the fixed charges on a steam plant costing, say, $90 per kw will be $13.50 per year, while the corresponding charges on a hydroelectric plant costing $150 will be $16.50, the balance being $3 per kw per annum in favor of the steam plant. One-half mill per kw-hr. is a liberal allowance for the operating expenses of a hydroelectric plant of large size, whereas the corresponding operating charges for a large steam plant will run from 4 mills to 10 mills per kw-hr., the variation in steam cost resulting from difference in size of plant, load-factor and efficiency.

Most successful hydroelectric plants are so designed that their forebays or ponds will hold the average flow of the stream for from twelve to twenty-four hours. It is also usual for such plants to have a much larger capacity in machinery than is required for the average output, as additional machinery can usually be added with a relatively small increase in outlay. These points make the co-operative service of steam and water-power plants highly advantageous, especially as it is much easier to start up an additional waterwheel than extra boilers and steam turbines. At the Vernon plant of the Connecticut River company the stream flow varies from 1500 cu. ft. per second to 150,000 cu. ft. per second. The primary output of the plant requires 3500 cu. ft. per second. In an average year the plant has sufficient water to carry its full load for nine months, only about 3,000,000 kw-hr. out of 50,000,000 kw-hr. being generated by steam. Much attention is being paid to storage on New England streams, and the recently constructed Somerset reservoir in southern Vermont, connected with the Deerfield River system, stores enough water now to produce approximately 25,000,000 kw-hr.,

which would otherwise be wasted. In conclusion, the speaker said that the water-powers of New England are to-day producing more than 2,000,000 kw-hr. of energy per year. If this energy were produced by coal, it would mean the annual consumption of 3,000,000 tons, worth about $15,000,000, and to produce, handle and transport this would require the continuous labor of 30,000 men working 3000 hours per year. Less than this number of men dug the Panama Canal in seven years, or in the same period could have built a double-track railroad from New York to San Francisco. The utilization of water resources stands on a par with the great inventions and discoveries of the age.

Conditions in Montana

In the annual report for the year 1914 Mr. John D. Ryan, president of the Montana Power Company, discusses business conditions. The decrease in consumption of energy resulting from curtailment of copper mining operations was largely overcome by improvement in other directions. From Aug. 1 to Dec. 31 gross earnings decreased less than 3 per cent and net earnings about 4 per cent. Mr. Ryan says:

"As a result of the European war the copper mines of the United States have been forced to curtail their production, and the mining companies in our territory have carried on operations at about 50 per cent of normal since August, 1914. It is gratifying, however, to note that the gross and net earnings of the company for the year 1914 showed a substantial increase over those of 1913. This favorable showing is due to the diversified character of the light and power business and to the steady growth of that business even in these depressed times. It must be remembered that no earnings have yet been received from the great enlargement in power plants now under way, which, while intended primarily to provide for the power requirements under the Chicago, Milwaukee & St. Paul Railway contracts, are also needed to care for the steady growth of the company's general business.

"Notwithstanding the present disturbed conditions, the outlook for the coming year is favorable, as extensions of the company's operations to new territories are expected to bring increased business which will to a large extent offset the decrease in business caused by the curtailed operations of the mining industries, if curtailment should continue. It is expected that the earnings will be increased by income from additional railway electrification during the last three months of the year, and changes now under way in the metallurgical plants of our mining customers will require a large amount of power in addition to what is now being used."

Developments in Cleveland Municipal Situation

At a meeting in the office of Mayor Baker of Cleveland arrangements were made for furnishing energy from the municipal plant for the new city hall. Energy will be supplied from the new plant at East Fifty-third Street, and a substation containing two rotary converters will be established at East Eleventh Street. This will be of sufficient size to serve the city hall and furnish additional energy. A bid has been made for furnishing service to the Federal Building.

Mayor Baker spoke before the public utilities committee of the House of Representatives in support of the Briggs bill, which seeks to exempt bonds issued for municipal light plants from the limitations fixed by present laws. He told the committee that bonds issued for water-works purposes are exempt from the limitation and can be authorized without vote of the people, although they may increase the total above the limit, and that there is the same reason for exempting bonds for electric-light purposes. The Briggs bill provides that electric-light bonds shall not be counted in the limitations placed upon municipal indebtedness whenever earnings are sufficient to meet operating expenses, interest and a sum each year to aggregate the bond indebtedness at maturity. The point has been raised that the bill does not make it mandatory upon municipalities to use the earnings of light plants for these purposes. It merely provides that earnings must be sufficient to meet these obligations. Mayor Baker advised the committee against the Myers bill, which provides that charges for service by municipal plants shall be sufficient to cover operating expenses and interest and return a sum equal to 5 per cent on the investment. He protested also against the Behnes bill, which makes the bonds a lien on the property only, instead of on the general tax duplicate of the municipality. Mayor Baker declared that these bills were formulated by electric-light interests.

Mayor Baker appeared before the finance committee of the Cleveland Chamber of Commerce to explain the Briggs bill. He told the committee that one of the principal purposes is to facilitate purchase of the property of the Cleveland Electric Illuminating Company by the city. He said he believed that this will be done and that it will be put to a vote of the people. The financing, he said, should be as simple as possible, and the amount of bonds should be determined by all the facts relating to the value of the property and the present city plant. Mr. W. G. Deitz of the committee suggested that any bonds issued for that purpose should not be long in term, as the revolution in light systems had been so great that the future might bring changes that would make the bonds practically worthless. A sub-committee was appointed to consider the bill further.

New Jersey Public Service Report

President Thomas N. McCarter of the Public Service Corporation of New Jersey, discussing in the annual report the returns for the year ended Dec. 31, 1914, shows that the corporation, though operating under adverse conditions, had, on the whole and relatively, a successful year. Severe storms in February and March of last year cost the subsidiary companies in loss of revenue and added operating expense upward of $300,000. Rates were lower and expenses higher in the gas department. Trainmen's wages were greater.

In addition to these conditions, the state of business depression which existed throughout the year was greatly aggravated by the European war. This depression was felt by all underlying companies. The normal annual gross increase in operating revenue of the Public Service Electric Company averages from 11 per cent to 12 per cent; last year the increase was 9.34 per cent. The normal increase in railway business averages about 5 per cent; in 1914 the increase was 1.11 per cent. The normal increase in gas business averages 7 per cent; in 1914 the increase was 3.61 per cent. Operating revenue of the subsidiary companies combined increased 3.85 per cent against an average normal increase of about 7 per cent. As compared, however, with the results obtained by railroad companies and other large public utilities these increases are considered to be satisfactory.

In speaking of the maintenance of the property at a high standard of efficiency, Mr. McCarter said that all of the property of the three subsidiary operating com-

panies is in first-class operating condition. It is true, of course, that some of the electric plants are old-fashioned and in a measure obsolete. Where this condition exists plants are being rapidly amortized and written off.

Taxes amounted to $2,202,555, an increase of $139,573. In addition the corporation contributed large sums in new improvements, street pavements and street-paving assessments. In five years the taxes have increased approximately $1,000,000. The increases have been so large and insistent that the matter is becoming very serious. It is urged that the limit has about been reached of the ability of corporations and individuals to meet the increases, however brought about, and that the authorities of the respective municipalities should realize that no further burdens of this character should be put upon property under present conditions.

In regard to the decision of the Court of Errors and Appeals in the Passaic gas case, Mr. McCarter expressed surprise that the motion for reargument made by the counsel of Paterson and Passaic and of the Board of Public Utility Commissioners, which was resisted by the company, was granted by the court.

A reargument of the whole case will therefore necessarily have to be made involving further delay. It is expected that the case will be argued at the March term. Mr. McCarter adds: "It is difficult to see how the court can depart from its sound decision already made."

AMERICAN TELEPHONE ANNUAL REPORT

Mr. Vail Says the Most Vital Economic Problems Are Relations Between Public and Utilities

The annual report of the American Telephone & Telegraph Company, as usual, informs stockholders fully of vital matters affecting their interests. In addition to the customary sections, there is a letter from Mr. Theodore N. Vail, president, addressed to the directors and security holders, on "Public Service."

Additions to plant and real estate aggregated $50,045,316 during the year ended Dec. 31, 1914; $73,091,000 was applied out of revenue to maintenance and reconstruction. The amount charged for depreciation was over $41,000,000, of which $15,000,000 was unused during the year. Attention is called to the fact that the effects of the disturbed business conditions in the country were not so serious for the Bell system as for most industries. Chiefly they were felt in retardation of usual growth. The increase in number of subscriber stations was only about 76 per cent of the number in 1913 and was less than in any one of the four years previous. The number of messages gained slightly over 2 per cent.

Most of the retardation in growth occurred in the latter half of the year, and steps were taken at once to reduce new construction expenditures by postponing such extensions as were not immediately necessary, with the result that additions to plant, which at the beginning of the year were estimated to aggregate $56,000,000, were $50,000,000. For 1915 it is estimated that current additions to plant will aggregate about $35,000,000, and construction work is on that basis. General business conditions are being watched, and should they improve as is hoped the construction program can be increased promptly to whatever extent seems justified.

It is believed from appraisals made by engineers of the company that the cost of reproduction of physical plants of the Bell system would exceed their book cost by some $61,000,000, aside from all intangible values. Net earnings were 5.5 per cent of plant and other assets last year; dividends and interest were 4.87 per cent.

Co-operation with Western Electric Company

As early as 1880, the report continues, it was recognized as important that an ample source of supply of approved apparatus should be provided for operating companies, and a contract was made with the Western Electric Company by virtue of which operating experience and manufacturing experience were brought into co-operation, under the supervision of the company's engineering forces, to provide standard apparatus. The apparatus was largely covered by patents and its sale was limited to the Bell telephone system. The operating companies were, and remained, free to buy of the Western Electric Company or elsewhere as seemed to them most desirable. When at a later period the plans involved connections with rural companies, it became advisable that they also should have standard apparatus, and all restrictions as to sales by the Western Electric Company were removed.

In evolution of the business, the Western Electric Company became also a source of supply of other materials not manufactured by it, and about fifteen years ago, at the suggestion of one of the operating companies, an arrangement was worked out by the Western Electric Company under which it assumed the relation of purchasing agent and storekeeper. This arrangement was adopted one by one by the other associated companies and for the long-distance lines department; and at the present time, as a result, the Western Electric Company is the purchasing agent and storekeeper of the entire Bell system. In both efficiency and economy the value of the relation to the system is enormous. Sales of the Western Electric Company in 1914 were $66,400,000, of which $43,900,000 represents sales to companies of the Bell system and $22,500,000 sales to other customers.

Engineering Department

In the Bell system standardization does not represent a standing still but means unceasing effort, continually improving and upbuilding, Mr. Vail says. During the last five years, under the standard specifications of the general engineering staff, new plant of all kinds costing more than $425,000,000 was added to the Bell system and plant to the value of more than $175,000,000 was removed from service. From 1906 to 1914 new construction work done under the engineering specifications amounted to more than $700,000,000.

A section of the general staff is constantly employed in studying electric-railway, electric-power and electric-light circuits and systems, and in co-operating with the electric light and power engineers in order to maintain harmonious relations between the two classes of circuits.

In extending the range of talking through underground cables and through overhead wires, thousands of inventions and engineering improvements have been utilized, including the loading coil of Dr. Pupin and others of very great importance.

The line from New York to San Francisco is overhead throughout its entire extent except for a few short stretches of cable in cities and under rivers. Notwithstanding improvements in underground cables, it is still necessary in such long lines as this to exclude as far as practicable all lengths of cable however short.

During the past year a type of underground cable carrying 2400 wires in a sheath having a diameter not greater than 2⅝ in. has been developed. This cable cannot yet be employed in lengths greater than a couple of miles in a given line. As the number of wires increases more and more use will be found for it, and there is reason to expect that as engineering development progresses it will be capable of use in increasing lengths, thus introducing a still further economy.

It takes an investment of nearly $4 to earn $1 gross revenue per year. This $1 of gross revenue is divided; 46.5 cents is paid in wages to employees, 5.5 cents goes for taxes, and 24.0 cents goes for material and other expenses, a very considerable part of which ultimately goes for wages, leaving as net operating revenue 24.0 cents, of which about 20.0 cents pays for the use of the $4 of capital invested. The remaining 4 cents of surplus revenue is actually expended for plant additions, of which about one-half is for wages.

It has been suggested that the government take the property and pay for it in 3 per cent bonds at par. This establishes nothing. If it can be taken and paid for in 3 per cent bonds at par, it can be taken and paid for with 2 per cent or 1 per cent bonds at par, or even be taken for nothing. Property can be taken only at just compensation based on fair valuation. The amount of taxes paid by privately owned public utilities annually in the United States is more than $200,000,000.

Payments by Subsidiaries

The report discusses the payment by subsidiaries to the parent company of a percentage of their gross revenue. For the centralized service, relieving the separated operating companies from the obligation of maintaining anything but an operating organization; for amortization of the cost and royalties of the many inventions; for the legal department at all times at the disposal of all companies, in all administrative matters; for maintenance and support of the very complete, extensive and effective technical and engineering department; for rental and care of telephones; for financial assistance; for all the service and the benefit of it all, the operating companies contribute 4½ per cent of their gross revenue. For the "administration" of the telephone business and for all the benefits that come from a common administration without which vastly greater sums of money would have been expended in operation, construction and obsolescence; for the advice and aid in legal and financial matters; for the right to use all inventions necessary and for protection in that right; for the expenses of administration—after deducting actual cost of furnishing telephones and maintaining them at the highest standard—the average contribution by operating companies is less than 3 per cent of their gross receipts.

Regulation

Mr. Vail says that regulation and control by commissions or business courts have, so far as anyone can forecast the future, become a permanent feature of our economic laws.

The few years' experience has brought out prominently both good and bad features, but it has demonstrated that there are great possibilities of good and a strong probability, if not a certainty, that there can be had through them a satisfactory solution of the economic problems as well as the correction of such business practices, of inherent badness, as were forcing otherwise conservative and right-seeing and right-believing people into the ranks of the extreme radicals. If the progress and development of the past are to be maintained, there must be abundant opportunity or individual initiative as well as individual reward for pioneer work.

Until everyone realizes, believes and acts on the belief that no man is too big timber for a court of commerce or public service commission these courts cannot have their proper position in the mind of the public. It is for the public to combine to encourage, support and sustain all these courts, commissions and the judges and members of commissions, and above all to abandon condemnation of all conclusions when they differ from selfish desires or opinions based on one-sided and insufficient information. It is for the public to realize that any particular gain, if at the expense of other interests, is not permanent gain at all, that all business or public prosperity is based upon each party to any transaction getting some benefit from it. Considered broadly and generally, Mr. Vail adds, the Bell system has no cause for complaint, protest or criticism as to its relations with legislatures, commissions, courts or municipalities. There have been fully as large a percentage of satisfactory conclusions arrived at by commissions as would have been the case in any regular courts of justice. No more could be expected.

Mr. Vail's Letter

In his letter Mr. Vail, while admitting frankly that "there is a condition of disturbance, of economic unsettlement which cannot continue indefinitely," adds that the company was never in better shape basically and that only combined effort to inculcate sound ideas and true understanding is requisite to the prompt removal of obstacles which now bar the way to general and permanent revival of business.

Taking up non-employment, Mr. Vail declares that if there could be a restoration of conditions which would inspire confidence in the securities of transportation and intercommunication companies sufficient to command the capital with which to begin the expenditure of even a part of the $1,000,000,000 a year needed to put these enterprises in a position to meet the demands of the country both as a "going" and as a "growing" concern, it would soon restore the normal conditions of employment, expenditure, consumption and production. Continuing, he says in part:

"The most vital of all present economic problems are the relations between the public and public service utilities, particularly those of interchange and intercourse—what constitutes proper regulation and control—what is the best method of securing their proper maintenance and further extension.

"The entire public, working or investing, should all stand by and uphold a control and regulation which will be thorough and effective and at the same time equitable, just and practical. But has the public ever remained complaisant when brought face to face with disturbance, uncertainty and non-employment caused by too drastic action or too radical legislation upon economic conditions or industrial enterprises?

"Control and regulation can become destructive instead of constructive; they can by delay paralyze commerce; they can through decrees of inexperienced officials impose unnecessary burdens and unnecessary expenditure upon corporations; they can require too many regulations and theories of operation and too many undeveloped experiments in plant and equipment; they can very easily run into operation. Demands of labor for increased wages and shorter hours, and demands of the public for increased service, must be met by increased revenue produced by increased rates. The application of scientific and improved methods to operation produced great results in reduction of expenses because it had an unworked field to start with, but it cannot be expected that the same ratio of progress will be indefinitely maintained. The irreducible minimum in unit expense has been reached in some industries and soon will be in all.

"No corporation, any more than an individual, can be bound hand and foot and yet be active or give good service. Bankrupt public service in time means bankrupt communities.

"Wealth never will be distributed equally nor always employed wisely, but where it exists in abundance there is always a chance for those who are willing to exchange their labor for some of it."

Mr. Carlton Finds Optimism in Telegraph Business

Mr. Newcomb Carlton, president of the Western Union Telegraph Company, finds a basis for optimism in the improving business of that company. To a representative of the ELECTRICAL WORLD Mr. Carlton said:

"We forget from year to year how conditions change. The point, however, is not whether business was good or bad in 1913 or 1914, but whether business conditions to-day are changing for the better. It is not whether earnings are below that we think they ought to be, but whether the curve of earnings is rising. No matter how low the barometer has gone or how severe the storm, the important fact to observe is whether the glass is rising. It is not where the top notch has been in the past or may be in the future, but the fact that business is rising from a low notch, that encourages us. Most people's business barometers are subject to limited atmospheric influence only. For example, the tradition that pig iron is the business barometer comes from the old country. It is a fairly reliable barometer there, but it is not so here because it is not sufficiently affected by agriculture. Pig iron is a trade barometer in this country. The value of the Western Union barometer is that it is influenced by the entire business atmosphere over the whole of the United States.

"When I was in the West not long ago and was talking about the reliability of our earnings as a barometer, some one spoke of the unfortunate condition of the railroads. Then he mentioned the iron and steel depression. I do not say that in many ways these industries, as well as others, have not been or are not in serious condition, but nevertheless returns covering all lines of business activity show that business is better—that the glass is rising.

"Take these facts. The week ended Oct. 2, 1914, showed that our earnings had decreased 8 per cent from the corresponding week of the previous year. From this date on the decreases ran from 1 per cent to 7 per cent until the week ended Dec. 18. In the week of Dec. 25 a gain of 1 per cent marked the turn in conditions. A slight setback to a 2 per cent decrease in the following week was followed by a gain of 2 per cent. In the week ended Jan. 22 earnings were the same as in the corresponding week of the previous year. Since then there have been no decreases. January as a whole increased 1½ per cent, February 3 per cent. Business in general is yet far from satisfactory, but a steady gain from a loss of 8 per cent in October to a 3 per cent increase in February is to my mind the best possible proof that the business barometer is rising."

Mr. Carlton sees a larger future for the telegraph. "We want to get people to think telegraphically," he said. "The use of the telephone has come to be automatic. It is no longer a mental operation; it is an impulse. The mental operation of sending a telegram is attended by the consciousness of definite cost. This is the result of old-fashioned training.

"We are trying to educate the public in the use and benefits of the telegraph and to appreciate that often the lack of a few telegraphed words subjects a whole organization to indecision, misdirection and lost energy. An organization that does business by telegraph and one that depends on the mail illustrate about the difference between an express train and a stagecoach. The obligation of the telegraph companies is to render efficient, dependable service with courtesy. Before every operator in our service we are placing the sign 'Accuracy first.' To improve speed we began by sending the filing time in code letters with each telegram. But we have improved on that, and in the last few weeks we have put the filing time in plain language on the message. If our service is bad, the customer is entitled to know it. We need the co-operation of the public to maintain dependable service. The fact that the public did not know what it was getting in the way of service has held back a freer use of the telegraph."

Mr. Carlton was asked about construction plans. He said: "Our theory is that the time to do construction work is when times are dull. When everyone else is shut down materials are cheap and labor efficient. We are still at work on the large reconstruction program outlined several years ago by Mr. Vail. We shall continue it until we complete the reconstruction of the main arteries. This work ought to be finished by the end of this year. Our appropriation for reconstruction and repairs for 1915 is about $8,000,000 for land lines only, and in addition we charge several thousand miles of new construction each year to capital account. Since June, 1910, we have spent $48,000,000 on construction, reconstruction and repairs."

Mr. M. L. Cooke Finds Fault with Utilities

Mr. Morris L. Cooke, director department of public works, Philadelphia, and acting director of the Utilities Bureau, gave two lectures on public utilities at Harvard University, Cambridge, Mass., on March 4 and 5. Mr. Cooke criticised the National Electric Light Association and the Bureau of Public Service Economics.

"Courtesies" between banking and utility interests have bound American cities hand and foot, Mr. Cooke said. Such courtesies, he declared, had so completely stopped competition in the field of public service that it was impossible to finance any competitive or municipal utility proposition, no matter how good. This policy of non-interference is "actually world-wide in its operation." Mr. Cooke went on:

"Especially in the electrical field it is almost impossible now to buy equipment for municipal or competitive plans. This is so well recognized that Mayor Baker of Cleveland announced before buying the machinery for Cleveland's new municipal electric plant that if held up by the manufacturers he would ask Congress to take the duty off foreign-made electrical machinery imported for municipal use."

Mr. Cooke declared that he was opposed to municipal ownership, at least for the present, because "we have our hands full now in learning the possibilities of municipal government." If the companies "furnish good service and fair rates, give them protection, a free field and a square deal. If they fail in these essentials, however, any self-respecting city will call the bluff by insisting on public ownership and public operation." Mr. Cooke declared that the public is asked to look upon the deliberations of public service commissions as scientific, while insiders know that the method of state regulation carried on under the most favorable circumstances is a hit-or-miss method. "We have been rushed into this era of state regulation with such rapidity that, humanly speaking, it is impossible for any commission more than to scratch the surface of the field that has been assigned to it." Many public service commission laws have been drafted with a view to giving an unfair advantage to private companies.

Mr. Cooke said: "Among the agencies which force compliance of standards and business practices imposed from the top are the national organizations provided for each type of utility, such as the N. E. L. A., the National Commercial Gas Association, the American Electric Railway Association and others. Practically every worker in these lines who is in good standing with the powers that be is forced to join in these organizations, and those who do not enjoy the favor of those at the top are virtually barred from membership.

"A typical organization of this type is the N. E. L. A.

To the uninformed it undoubtedly has the standing of a scientific and technical society. While it does a considerable amount of scientific work, it is essentially a trade body and one not always operating quite as openly as would appear to be for the best interest of the community. In order to build up a position as a technical society, this association formerly gave out technical information as do other national engineering and scientific societies. This has been prohibited because the members do not want this information to fall into the hands of possible business rivals, and more especially into the hands of public service commissions and others investigating their methods.

"Notwithstanding a membership of many thousand, no one can join the N. E. L. A. who does not work for a company which already belongs to it. Since they do not usually allow competing companies to join, no individual employer or competing electric company can be a member.

"For instance, all employees of the Commonwealth Electric Company of Milwaukee, a company doing a business of $400,000 annually, are barred from membership.

"The N. E. L. A. also works in close harmony with and supports such sexless public-opinion-forming agencies as the Bureau of Public Service Economics. In 1913 the rate research committee of the N. E. L. A. announced its theory of rates based on the 'value of service,' which of course is nothing more than a new rendition of 'all the traffic will bear.' Notwithstanding a vociferous beating of the tom-toms, there were no large number of converts to the doctrine. Cost plus a fair profit is as good a rule in this field as any other."

Mr. Cooke criticised Prof. M. E. Cooley, Dr. Alexander C. Humphreys and Prof. George F. Swain.

Engineers Discuss Changes in New York State Constitution

A department of public works to take over all bureaus of the New York State government having charge of engineering work was indorsed as a desirable amendment to the New York constitution at a meeting held on March 17 in the house of the American Society of Civil Engineers. The meeting was called in anticipation of the New York constitutional convention, which will convene April 17, and gave an opportunity for the members to assist with their suggestions the committee appointed by the board of directors to represent the society at the convention. Other recommendations were that the Governor be empowered to appoint a consulting engineer to advise him on engineering matters and that there be instead of the two present Public Service Commissions a department of public utilities headed by a commission of three, one of them an engineer.

Operating Results of Steam-Railroad Electrification

Results obtained through electrification of steam railroads were described by engineers connected with five recent important electrifications at the meeting of the Western Society of Engineers, Chicago, March 16, held during the convention of the American Railway Engineering Association in that city.

The Norfolk & Western Electrification

Mr. George Gibbs, consulting engineer for the Pennsylvania and Norfolk & Western railroads, discussed the use of phase converters on the latter's locomotives for converting the single-phase line energy into three-phase current for the motors. The Norfolk & Western installation has now been in service about thirty days. Each locomotive weighs 270 tons, 220 tons of which rests on the driving wheels. A single locomotive has developed 11,000 hp and drawbar pulls of 170,000 lb.—certainly the greatest power ever developed by any locomotive, whether steam or electric. The electric locomotives maintain speeds of 14 miles per hour, pulling trains of the 100-ton Norfolk & Western coal cars, compared with schedule speeds of 7 m.p.h. for the Mallett steam locomotives. The eleven electric locomotives have displaced thirty-three steam units. The power house contains three 10,000-kw turbine-alternators and transmits 44,000-volt single-phase energy, which is stepped down to 11,000 volts trolley pressure at the static substations.

Pennsylvania Suburban Lines to Paoli

The 21-mile electrification of the Pennsylvania Railroad's Philadelphia suburban service from the Broad Street station to Paoli is now undergoing test. The single-phase 10,000-volt catenary trolley system is employed, with steel motor cars having pantagraph collectors. This installation was made, explained Mr. Gibbs, to afford relief at the Broad Street terminal by simplifying train movements. As the result, the existing suburban track facilities have been increased 18 per cent and the total station facilities 8 per cent. The series-repulsion motors employed on this installation are rated at 225 hp each.

Results of New York Central Experience

Mr. E. B. Katté, chief engineer of electric traction, New York Central, compared the cost of steam and electric locomotives. Whereas an ordinary steam locomotive cost $25,000, an electric locomotive costs $45,000, and including power house, distributing system, etc., represents a unit investment of about $110,000. The cost of steam operation averages 26 cents per ton-mile, while electric operation costs 21 cents per mile. Maintenance of the New York Central's distribution system averages $8 per circuit-mile for the three-phase lines and $13 per circuit-mile for direct-current lines. Energy is manufactured at a fuel cost of 0.45 cent to 0.50 cent per kw-hr., or 0.75 cent including fixed charges. Delivered at the contact shoes, with various distributing costs and losses included, this traction energy costs 1.75 cents per kw-hr. The New York Central locomotives are now operating 22,000 miles per detention, and the multiple-unit suburban cars average 51,000 miles per detention.

Mr. W. S. Murray, consulting engineer New York, New Haven & Hartford Railroad, sent a paper which was read in his absence, and in which he summarized the saving due to electrification as being one-half of the coal pile, besides a great increase in track capacity. During January, 1915, he said, 40,000,000 ton-miles of trailing load were carried over the New Haven electrification, which with sidings now totals 500 miles. The electric-switching service is now being performed with one failure for every 1,000,000 miles. Mr. Murray referred to the success of the mercury-arc rectifier for converting single-phase into direct current for locomotive motors.

Plans for the "St. Paul" Installation

Mr. C. A. Goodenough, assistant to the president of the Chicago, Milwaukee & St. Paul Railway, sent a paper describing the electrification of his road's mountain division, which is to be ready for operation by October of this year. The section from Three Forks to Harlowton will be next electrified, and the entire 440-mile installation is to be completed by Jan. 1, 1918. Later the electrification zone may even be extended 850 miles west to Seattle and Tacoma.

Miscellaneous News Notes

Electricity Replaces Oil in Willys-Overland Furnaces.—The Willys-Overland Company, automobile manufacturer, has contracted with the Toledo (Ohio) Railways & Light Company for 6000 kw for the operation of enameling and tempering furnaces. Crude oil was formerly used.

The Columbus Municipal Plant.—Superintendent Harry E. Eichorn, of the municipal light plant at Columbus, Ohio, has requested the city to make an appropriation to pay the expense of street lighting and service in public buildings. He believes that payment for the service in this way will make the plant self-sustaining.

Increasing Demand in Electrified Zinc-Mining Field.—The electrical output of the Interstate Light & Power Company, whose central station at Galena, Ill., serves the Illinois-Wisconsin zinc-mining field, has shown an increase of 24 per cent for the first two months of 1915 as compared with the preceding year. High prices for zinc ore have materially stimulated mining operations in this district.

A Match for the Thief Who Stole the Red-Hot Stove.—The classic narrative of the Wild West bandit who made off with the station agent's stove in which a coal fire was cheerily burning finds a latter-day sequel in the feat of a St. Louis thief who cut down 200 ft. of No. 4 copper wire from a line supplying service to a factory which was in full operation at the time. The first warning the customer had was the sudden stopping of his motors. Investigation showed that the wires had been cut with a hatchet. The culprit was finally found and sent to the workhouse for sixty days.

To Open Utah Aluminite Deposits.—It is reported from Salt Lake City, Utah, that preparations are being made by the Florence Mining Company, Pittsburgh, and Armour & Company, Chicago, to open large aluminite deposits in the vicinity of Marysvale. The combined investment of the two companies in Utah is estimated at approximately $3,000,000. The Florence company has purchased land on the Sesier River on which to erect a power plant, and the Beaver River Power Company has let the contract for a $250,000 power plant on the Beaver River east of Beaver. The work on the plants is scheduled to start early in the spring. The deposits to be opened, it is claimed, contain 35 per cent aluminite and 11 per cent potash.

Difference of One Letter in Franchise Agreement Involves Thousands.—Two different versions of the franchise agreement between the corporation of Houston Heights, a suburb of Houston, Tex., and the local lighting company have held up the ratification of the document by the Town Council. The disagreement involves the rate at which energy is to be sold to the town for street lighting. According to one copy, "the citizens *or* the city of Houston Heights" were not to pay higher rates for service than those charged in the neighboring city of Houston, while according to the other version this provision related only to "the citizens *of* the city of Houston Heights." If the text containing the word "or" is adhered to, the town will save about $1,000 a year on its street-lighting bill.

Ohio Court Will Not Review Cincinnati Decision.—The Ohio Supreme Court has declined to review the decision of the Hamilton County Court of Appeals by which the city of Cincinnati was granted a permanent injunction preventing the Diamond Light Company from following its plan of making use of the streets and alleys for a distribution system and selling energy to consumers without a franchise from the City Council. This gives the city a final victory over the company, which had contended that it could go ahead and lay conduits under streets and alleys or string wires over them through consents of owners of abutting property so long as it did nothing to interfere with traffic on the thoroughfares. The Court of Appeals granted the city a perpetual injunction. It is stated that the company may ask the Council for a franchise and, in case this is refused, it may put the question before the people on a referendum vote. The Court of Appeals decided that if the City Council enacted legislation that required companies to secure city franchises it would be necessary for them to do so. Owners of properties on streets and alleys have not authority to grant a company the right to use the streets and alleys.

Associations and Societies

Lynn Section, A. I. E. E.—At a regular meeting of the Lynn (Mass.) Section of the A. I. E. E. on March 17, Dr. W. P. Davey, Research Laboratory, General Electric Company, Schenectady, N. Y., was scheduled to deliver an illustrated lecture on "Recent X-Ray Developments."

Convention of Gas, Electric and Street Railway Association of Oklahoma.—The fourth annual convention of the Gas, Electric and Street Railway Association of Oklahoma will be held in Oklahoma City, May 12, 13 and 14, the headquarters being at the Lee-Huckins Hotel. Mr. H. V. Bozell, Norman, Okla., is secretary-treasurer.

Mr. Martin Addresses New York Section on Exposition Lighting.—Secretary T. C. Martin of the National Electric Light Association addressed 500 people at the meeting of the New York Company Section in the Edison auditorium, on March 15, on the lighting features of the two expositions in California, that at San Diego and the one at San Francisco. The address was illustrated with lantern slides.

New York Electrical Society.—The 336th meeting of the New York Electrical Society will be held at the Engineering Societies Building, New York, March 25. Mr. T. Commerford Martin will give an address on "Electrical Aspects and Lessons of the San Francisco Exposition." A brief portion of the address will be devoted to the lighting of the Panama California Exposition at San Diego, itself a gem of art.

Building Up a Large Fleet of Commercial Vehicles.—Mr. C. C. McMahon, assistant to the superintendent of the transportation department of the Commonwealth Edison Company, addressed the Chicago Section of the Electric Vehicle Association March 10 on the subject of experiences encountered in building up the Edison company's large fleet of commercial cars, which perform a diversified delivery service. The Chicago Section E. V. A. now meets weekly for Tuesday luncheon at the Hotel Metropole, 2300 South Michigan Avenue, in the heart of the retail automobile district of the city.

Iowa Section, N. E. L. A.—The Iowa Section of the National Electric Light Association will hold its annual convention at Keokuk, Ia., April 20 to 22 inclusive, some of the sessions overlapping those of the Iowa Street & Interurban Railway Association and the Iowa Electrical Contractors' Association, which will hold annual meetings in Keokuk about the same time. Among reports and papers which will be presented at the N. E. L. A. meeting are: Report of committee on "Possibilities of Business from Rural Transmission Lines"; report of committee on "Workmen's Compensation Insurance as It Affects Public Utilities"; "Gas-Filled Street-Lighting Lamps and Fixtures," by Messrs. E. M. Walker of the Union Electric Company, Dubuque, and Thomas Crawford of the Clinton Gas & Electric Company, Clinton; "Gas-Filled Tungsten Lamps," by Mr. Henry Schroder, assistant manager of the Edison Lamp Works, Harrison, N. J.; "Basic Principles of Rate-Making for Central Stations," by Mr. F. A. Warfield, rate engineer, Illinois Traction System, Peoria, Ill.; "Controlled Flat Rates in Connection with the Excess Indicator," by Mr. E. T. Hughes, new-business manager of the Union Electric Company, Dubuque; "Power Development Methods for Iowa Central Stations," by Mr. Edward Soukup, new-business manager of the Iowa Railway & Light Company, Cedar Rapids, Ia.; "Maximum-Demand Meters," by Mr. J. V. Montgomery, of the Mississippi River Power Company, Keokuk; "Oil Engines for Small Light and Power Stations," by a representative of the Busch-Diesel Oil Engine Company, St. Louis, Mo.; revised report of the facts and factors committee, and "Financial Side of Electric Power Transmission," by Prof. Arthur H. Ford, of the State University of Iowa. Following the presentation of the papers an illustrated lecture on "Safety First" will be given. Entertainment will include a banquet followed by an illustrated lecture on the development of the Keokuk hydroelectric plant, an automobile trip, a smoker, theater parties, rejuvenation of the Sons of Jove, etc. It is intended to charter one of the large Mississippi River boats for the last afternoon of the convention. Space has been provided for displaying electrical appliances. Mr. Rex H. Fowler is assistant secretary of the association.

Public Service Commission News

New York Commissions

Pending the hearing before Governor Whitman on March 23 in regard to the charges against four members of the First District commission, the legislative investigating committee is proceeding with the examination of the Second District commission. Messrs. Frank H. Mott, secretary, and Charles R. Barnes, electric railroad inspector of the Second District commission, testified.

Ohio Commission

The request of the Union Gas & Electric Company of Cincinnati for an extension of time to May 1 in which to complete appraisal of its property was refused by the commission. Work has been in progress on the appraisal for several months, and at the same time representatives of the commission have been checking the figures. Vice-president W. Y. Cartwright of the company said that the inventory has been completed and engineers are tabulating and consolidating the data. He said that the work had been progressing as rapidly as possible and that there is every prospect that it will be completed by May 1.

The commission has dismissed the case of the city of Sandusky against the Sandusky Gas & Electric Company, in which an adjustment of rates was requested. A settlement has been reached. New rates were effective from March 9.

To prevent unwarranted and unfair competition, Representative W. R. Sprague has introduced in the Ohio House of Representatives a bill to require any company which seeks to establish a light and power plant in a city or town already having service from an established plant to secure a certificate of necessity from the commission. The same provision is made for artificial and natural-gas, water-works, heating and cooling plants. This certificate must be obtained before the first step is taken toward construction. The bill would place electrical plants under the same conditions in this respect which the telephone companies have had for two years. Municipal plants are specifically excluded from the operation of the bill.

Massachusetts Commission

The commission has issued an extended report discussing the necessity of a broad investigation of telephone service and rates within the State, in response to a legislative order issued last February asking the board to report upon the relations between the New England Telephone & Telegraph Company and the American Telephone & Telegraph Company, their bearing on rates, and the general method of ratemaking employed by the New England company. The commission finds that the present rate schedules of the New England company have all been fixed or approved by State authority and not by the American company; but, in view of the contractual relations between the two companies and the financial control exercised by the American over the New England company, asks for an appropriation to enable it to conduct a comprehensive investigation.

The American company now owns 58 per cent of the capital stock of the New England company. There are numerous contractual relations between the two companies. They jointly own and use some pole lines, lease equipment to each other, and interchange engineering data. The most important contract is one under which the American company furnishes to the New England company telephone instruments and the expert services of its general staff and rights in inventions and improvements. Under these relations the New England company, in common with other subsidiaries of the Bell system, pays the American company 4.5 per cent of its gross receipts each year. The commission has been unable to investigate in the time and with the means at its disposal whether these relations are equitable, but cites recent reports of the commissions in Vermont, California and Georgia upon this subject. The general tenor of these reports is to the effect that subsidiaries pay an unduly large sum to the American company.

An extended résumé is given of the relations between the New England company and the Western Electric Company, the latter being in effect the exclusive purchasing agent of the former. The history of the Western Electric Company in relation to its services to Bell subsidiaries is reviewed in considerable detail, the commission, however, coming to no conclusion as to the equity of these relations.

Personal

Mr. William Siebenmorgen, chief engineer of the C & C Electric & Manufacturing Company, Harwood, N. J., has resigned.

Mr. I. J. Bell, who has been manager of the Interstate Public Service Company at Bedford, Ind., for the past twenty-two years, has resigned.

Mr. James Mitchell, vice-president of the Alabama Power Company, has been elected president of the company, vice Mr. Frank S. Washburn, who becomes chairman of the board of directors.

Mr. W. L. Martin, who has been in charge of the legal department of the Alabama Traction, Light & Power Company, New York, N. Y., has been appointed vice-president and chief counsel of the company.

Mr. W. E. Murchie has been appointed local manager of the Interstate Public Service Company's system at Bedford, Ind., as successor to Mr. I. J. Bell. Mr. Murchie was manager of the Southern Indiana Power Company at Bedford.

Mr. D. C. Green has been appointed manager of the Salt Lake division of the Utah Power & Light Company. Mr. Green was formerly connected with gas and electric interests in Everett, Wash., San Diego and Monroe, Cal., Marshfield and Albany, Ore.

Mr. Frank S. Washburn, president of the Alabama Power Company, Birmingham, Ala., has retired as president of the company to assume the chairmanship of the board of directors, and Mr. James Mitchell, present vice-president of the company, succeeds him.

Mr. C. K. Morrell, has resigned as superintendent of lighting with the Kentucky Traction & Terminal Company, Lexington, Ky., and has been succeeded by Mr. Washington Reed, lately of Smithfield, Va. Mr. Morrell, it is said, will enter business in Lexington.

Mr. William D. Ray has resigned as vice-president and manager of the Northern Indiana Gas & Electric Company's properties at Hammond, East Chicago and Whiting, Ind., serving important industrial suburbs of Chicago, to become general manager of the newly organized Pennsylvania Utilities Company, with headquarters at Easton, Pa. The latter company operates in fifteen communities in the vicinity of Easton, in a district containing many quarries, cement plants, steel mills, paint factories, etc. Mr. Ray's career in the electrical field has been a varied one, beginning with his work as electrical engineer for the Chicago & Northwestern and Northern Pacific railroads and his later connection with the World's Columbian Exposition at Chicago as assistant superintendent of electrical operation. In 1894 he was general superintendent of the Everett (Wash.) Street Railway, and later he became sales engineer for the Loraine Steel Company. Removing to Michigan, he became electrical engineer for two traction lines operated by the Detroit Construction Company, and afterward superintended the construction of the Grand Rapids-Muskegon third-rail road. In 1908 he was appointed contract agent of the Sanitary District of Chicago. In 1910 Mr. Ray went to Hammond to take charge of his recent work for the Northern Indiana Company, in addition to which he has been a leader in local civic movements. Mr. Ray is a member of the National Electric Light Association and has for twenty-two years been a member of the American Institute of Electrical Engineers. He is vice-president of the Indiana Electric Light Association and of the Electric Club of Chicago.

W. D. RAY

Mr. Leonard Work, formerly with the Westinghouse Electric & Manufacturing Company, and later with the construction department of the Isthmian Canal Commission at Panama, has recently been appointed electrical and me-

chanical engineer to the Department of Wharves, Docks and Ferries, Philadelphia, Pa.

Mr. L. M. Levinson, formerly manager of the Mineral Wells Traction & Light Company, Mineral Wells, Tex., and manager of the Shreveport (La.) Traction Company, has been engaged by the Bryan-College Interurban Railway, Bryan, Tex., to supervise the electrification and start operations under the new plan of the company. His title is acting manager.

Mr. S. T. Whitaker, local manager of the Utah Light & Traction Company at Ogden, Utah, has tendered his resignation, and the local affairs of the company will be looked after by Mr. P. M. Parry, local manager of the Utah Power & Light Company. The Utah Light & Traction Company and the Utah Power & Light Company were recently consolidated, and the Utah Power & Light Company leases and will manage the combination properties.

Mr. Thomas R. Woulfe, manager of the light and power department of the Cleveland, Southwestern & Columbus Railway Company, Cleveland, has tendered his resignation, effective April 1, and will engage in consulting engineering. Mr. Woulfe will go into partnership with Mr. Frank B. Rae, of Cleveland, and the firm, which will be known as the Rae-Woulfe Company, will act as consulting electrical and mechanical engineers. Mr. Woulfe has been with the Cleveland, Southwestern & Columbus Railway Company for three years, and prior to joining the staff of that company was superintendent of gas and electric properties for the Illinois Northern Utility Company, Sterling, Ill. He was one of the organizers and a director of the Kehoe Light & Power Company, Fort Wayne, Ind., of which he was assistant general manager until the company was taken over by the Fort Wayne & Wabash Traction Company. Mr. Woulfe graduated from Notre Dame University as an electrical engineer. He is a member of the American Institute of Electrical Engineers and of the Electric League of Cleveland.

Mr. Robert K. Sheppard, who was elected president of the Associated Manufacturers of Electrical Supplies last week, has acted as chairman of all the preliminary meetings of manufacturers leading up to the formation of the association and as their spokesman before other organizations. Mr. Sheppard was born in Boston in 1871, was educated at the Newton High School, and was graduated from the Massachusetts Institute of Technology in 1895 as a chemical engineer. After graduation he entered the employ of the Washburn & Moen Manufacturing Company, Worcester, Mass. He remained with that company and with the American Steel & Wire Company, which absorbed it, until 1912. Part of this time was spent in the operating and manufacturing department, but the greater part in the sales department. In 1899 Mr. Sheppard was sent to New York by his company, where he was connected with the sales end of the insulated wire department. He removed to Chicago in 1902 and was connected with the insulated wire and rope department. In 1904 he became the representative of the American Steel & Wire Company in Philadelphia, where he remained until 1912. He then entered the employ of the Diamond Rubber Company of Akron, Ohio, which was afterward amalgamated with the B. F. Goodrich Company, manufacturer of rubber goods of all kinds. Mr. Sheppard is manager of sales of the insulated-wire department. In recognition of his work leading up to the formation of the Associated Manufacturers of Electrical Supplies, he was presented with a silver loving cup by the members of the organization committee at the March 9 meeting. Mr. Sheppard is an associate member of the American Institute of Electrical Engineers, a member of the Art Club of Philadelphia, of the Spring Haven Country Club, of the Cleveland Athletic Club, and of the Portage Country Club of Akron.

R. K. SHEPPARD

Corporate and Financial

Fort Worth Power & Light Preferred Stock.—Richardson, Hill & Company, of Boston, Mass., are offering 7 per cent cumulative preferred stock of the Fort Worth (Tex.) Power & Light Company.

Investors' Almanac.—Bowman, Cost & Company, of St. Louis, Mo., are distributing to their clients and friends copies of the 1915 Investors' Almanac, which is a handbook of information for investors.

Southern Illinois Light & Power Bond Issue.—Bowman, Cost & Company of St. Louis, Mo., are offering $100,000 first mortgage 6 per cent gold bonds of the Southern Illinois Light & Power Company at par and interest.

West St. Louis Water & Light Bond Offering.—Shapker, Anderson & Company of Chicago are offering at 93 and interest to yield 5.75 per cent $200,000 West St. Louis (Mo.) Water & Light Company's first mortgage sinking-fund 5 per cent gold bonds due on Aug. 1, 1928.

Virginian Power Bond Offering.—A. B. Leach & Company of New York are offering $3,800,000 first and collateral trust mortgage 5 per cent gold bonds, due on Dec. 1, 1942, of the Virginian Power Company, Charleston, W. Va., at 90 and interest with a stock bonus of $300 par value.

Northern New York Utilities Stock Increased.—The Northern New York Utilities Company of Watertown, N. Y., has filed a certificate of increase of authorized capital stock from $2,000,000 to $4,000,000, to consist of $2,000,000 common stock and $2,000,000 7 per cent cumulative non-voting preferred stock. There is now $684,000 common stock and $472,800 preferred outstanding.

Central California Electric Corporation.—The Central California Electric Corporation, which was granted a charter in Delaware recently, will not engage at present in the generation and distribution of electrical energy, but will deal in the securities of public service and non-public service corporations according to advices received from Mr. DeLos A. Chappell, one of the incorporators.

United Railways Investment Fiscal Year Change.—The fiscal year of the United Railways Investment Company, San Francisco, Cal., has been changed to start with July 1. The annual meeting will be held in October instead of the first Friday in May. The action was taken in order that the parent company might issue its report at the same time as its subsidiaries so that a consolidated statement can be made.

Western Railways & Light Control Passes to Illinois Traction.—The plans for merging the Western Railways & Light Company with the Illinois Traction System which were approved by stockholders of both companies have been carried out. For 22,534 shares of Illinois Traction Company common stock 45,086 shares of Western Railways & Light Company common stock, out of a total of 45,218 shares outstanding, were exchanged.

Aldred Interest in Baltimore Utilities.—Aldred & Company of New York, fiscal agents of the Consolidated Gas, Electric Light & Power Company of Baltimore and of the Pennsylvania Water & Power Company, have acquired for themselves and associates a substantial interest in the stock of the United Railways & Electric Company of Baltimore, through purchases made in the market and directly from a larger interest in the company. Mr. James E. Aldred will be made a director of the railway company.

Pacific Gas & Electric Earnings.—Earnings of the Pacific Gas & Electric Company for the year ended Dec. 31, 1914, were as follows:

	1914	1913
Gross earnings	$17,220,503	$16,202,337
Operating expenses, maintenance and taxes	8,913,921	9,331,207
Net earnings	$8,306,582	$6,871,130
Annual bond interest	4,004,480	
Balance	$4,302,102	

Pacific Gas & Electric Sells Bonds.—N. W. Halsey & Company and Harris, Forbes & Company, of New York, have purchased from the Pacific Gas & Electric Company $2,000,000 general and refunding mortgage bonds, which are at present deposited as collateral for the notes of that company maturing on Dec. 15, 1915. It is expected that in

the course of the next few months they will also purchase the balance of $3,000,000 of these bonds that are now being used as collateral for the notes. This will, of course, involve the retirement of the notes.

Montana Power Annual Report.—The annual report of the Montana Power Company for the year ended Dec. 31, 1914, shows a gain of 1880 customers during the year and an increase in connected load of 10,000 kw. The combined earnings of the company and its subsidiaries for 1913 and 1914 follow:

	1914	1913
Gross earnings	$3,778,285	$3,539,198
Operating expenses and taxes	1,139,046	1,117,774
Net earnings	$2,639,239	$2,421,424
Interest charges	1,063,614	904,555
Surplus over charges	$1,575,625	$1,516,869

Pacific Power Income Statement.—The income statement of the Pacific Power Company of Bodie, Cal., for the year ended Dec. 31, 1914, follows:

Operating revenue	$123,845
Operating expenses	52,962
Net operating revenue	$70,883
Gross corporate income	$70,883
Interest	72,205
Deficit for year 1914	$1,322
Profit and loss balance Dec. 31, 1913	91,018
Balance Dec. 3, 1914	$92,340

Baltimore Consolidated Stockholders to Vote on Stock Increase.—A special meeting of stockholders of the Consolidated Gas, Electric Light & Power Company of Baltimore has been called for March 22 for the purpose of increasing the total common stock of the company authorized to be issued from $20,000,000 to $30,000,000. The object of the increase, according to a statement by President H. A. Wagner, is to provide for the normal growth of the company. It is not intended to make an additional issue of common stock immediately upon authorization. The action is taken now in order to prepare for future requirements. A certain portion of the common stock will be set aside to take care of the exchange or conversion privilege of the other securities.

Duluth Edison Report.—The report of the Duluth Edison Electric Company, which was filed recently with the city auditor of Duluth, states that during the year just passed $45,387 was spent for improvements, increasing the total cost of the system to $3,127,512. For the year ended Dec. 31, 1914, earnings were:

Gross earnings		$549,812
Operating expenses		282,187
Net earnings		$267,625
Taxes and insurance	$26,150	
Bond interest	67,650	
Sinking fund addition	25,000	
Sinking fund bond interest	12,814	
Total	$131,614	131,614
Balance		$136,011

Southern Sierras Power Statement.—The income statement of the Southern Sierras Power Company, Denver, Col., for the year ended Dec. 31, 1914, follows:

Operating revenue		$458,363
Operating expenses		186,092
Net operating revenue		$272,271
Non-operating revenue		4,040
Gross corporate income		$276,311
Deductions:		
Interest	$189,393	
Miscellaneous	14,609	204,002
Surplus for year 1914		$72,309
Profit and loss balance Dec. 31, 1913		41,968*
Balance		$30,341
Additions to surplus		8,067
Surplus Dec. 31, 1914		$38,408

*Loss.

New England Power Merger Planned.—Plans have been matured for the merger of hydroelectric systems financed by Baker, Ayling & Company, Boston, Mass., into an organization to be known as the New England Company, controlling plants with 70,000 hp in generating capacity and transmission lines spanning the greater part of central New England. The New England Company was organized last year in Massachusetts with a stock capitalization of $8,370,000 and authorized bonds up to $30,000,000 in a 5 per cent forty-year issue, the plan being to take over the New England Power Company of Maine, the Connecticut River Power Company of Maine, the Connecticut River Power Company of New Hampshire, and the Bellows Falls (Vt.) Power Company. The consolidation will simplify organization, operation and financing and is designed to unify further the systems developed by Chace & Harriman, Boston, during the past few years.

Oro Water, Light & Power Report.—The following earnings report for the year ended Dec. 31, 1914, has been placed on file with the California Railroad Commission by the Oro Water, Light & Power Company, Oroville:

Operating revenue		$88,008
Operating expenses		72,548
Net operating revenue		$15,460
Non-operating revenue		201,510
Gross corporate income		$216,970
Deductions:		
Non-operating expense	$441	
Interest	20,760	21,201
Surplus for year 1914		$195,769
Balance Dec. 31, 1913		552,376
Total		$748,145
Deductions for year:		
Dividends, sinking fund appropriations and other appropriations		251,414
Surplus Dec. 31, 1914		$496,731

The West India Electric Company's Statement.—The annual report of the West India Electric Company, Ltd., for the year ended Dec. 31, 1914, shows the following:

		1914		1913
Earnings:				
Railway		$206,870		$212,157
Electric light		64,562		56,864
Power		9,780		9,611
Miscellaneous		7,713		6,209
Total		$288,925		$284,841
Expense:				
Transportation	$65,480		$54,957	
Maintenance	30,263		29,137	
General expenses	59,486		63,646	
Total		155,229		147,740
Fixed charges:				
Interest on bonds	$30,000		$30,000	
Tax on railway earnings	8,327		8,517	
Rental	12,000		12,000	
Total		50,327		50,517
Net income		$83,369		$86,584

Bell Telephone Income Statement.—A comparative income statement of the Bell Telephone System in the United States for 1913 and 1914 is presented herewith. All duplications, including interest, dividends and other payments to the American Telephone & Telegraph Company by associated holding and operating companies, have been excluded:

	1914	1913
Gross revenue	$225,952,123	$215,572,822
Expenses:		
Operation	81,396,219	75,404,092
Current maintenance	31,595,388	32,442,979
Depreciation	41,496,240	37,739,991
Taxes	12,216,997	11,296,237
Total expenses	$166,704,844	$156,883,299
Net revenue	$59,247,279	$58,689,523
Interest	18,940,641	16,652,624
Balance net income	$40,306,638	$42,036,899
Dividends paid	30,304,186	30,301,705
Balance for surplus	$10,002,452	$11,735,194

Present and Future of American Business.—Harris, Winthrop & Company, dealers in investment securities in New York and Chicago, have issued a fifty-two-page pamphlet entitled "The Present and the Future of American Business," which is the composite opinion of 700 American business men. A letter containing seven questions on present and future business conditions was sent to 2000 men identified with constructive commerce and finance in the United States. The replies showed that the jobbers and distributers have small stocks of goods on hand, that those who are able to save are allowing savings to accumulate in the banks, that there is an unusually large number of unemployed, that the increased cost of freight is not appreciable, that the supply of money is normal, but that credit is being closely scrutinized, that economy is becoming general both from necessity and choice, and that the outlook for American business during 1915 is encouraging.

American Telephone & Telegraph Report.—The annual report of the American Telephone & Telegraph Company for the year ended Dec. 31, 1914, shows the following earnings and expenses:

Earnings:	1914	1913
Dividends	$25,638,205	$26,122,573
Interest and other revenue from associated companies	13,959,944	13,564,952
Telephone traffic (net)	5,530,454	5,548,089
Other sources	1,067,996	674,377
Total	$46,196,599	$45,909,991
Expenses	5,638,622	5,333,245
Net earnings	$40,557,977	$40,576,746
Interest	8,223,163	7,656,656
Balance	$32,334,814	$32,920,090
Dividends	27,572,675	27,454,037
Balance	$4,762,139	$5,466,053
Carried to reserves	$2,500,000	$2,500,000
Carried to surplus	2,262,139	2,966,053
Total	$4,762,139	$5,466,053

Narragansett Electric Lighting Company's Report.—The annual report of the Narragansett Electric Lighting Company, of Providence, R. I., shows that gross earnings increased $141,410, or 9.25 per cent over the previous year. Energy sales amounted to 36,477,837 kw-hr., an increase of 13.5 per cent. New business for the year aggregated 8,651 kw, an increase of 18.7 per cent. The total connected load of the company on Dec. 31, 1914, was 76,000 hp. The statement follows:

Gross earnings from all sources		$1,670,654
Operating expenses	$954,775	
Depreciation of property and plant	166,266	
Interest on debentures	20,000	
Other interest charges	35,456	1,176,497
Net income		$494,157
Profit and loss adjustments		6,134
Total income		$500,291
Disposition of income:		
Dividends		480,000
Credited to surplus		$20,291

Truckee River General Electric Report.—The income statement of the Truckee River General Electric Company, of Reno, Nev., for the year ended Dec. 31, 1914, is presented herewith. The company is controlled by the Sierra Pacific Electric Company of Reno:

Operating revenue		$278,039
Operating expenses		109,860
Net operating revenue		$168,179
Non-operating revenue		406
Gross corporate income		$168,585
Deductions:		
Non-operating expense	$1,964	
Interest	90,787	92,751
Surplus for year 1914		$75,834
Profit and loss balance Dec. 31, 1914		546,625
Total		$622,459
Additions to surplus		1,000
Total		$623,459
Deductions for year:		
Dividends	$120,000	
Other appropriations	93,426	213,426
Surplus Dec. 31, 1914		$410,033

Midland Counties Statement.—The Midland Counties Public Service Corporation, San Luis Obispo, Cal., has filed the following statement with the Railroad Commission of California for the year ended Dec. 31, 1914:

Operating revenue		$205,264
Operating expenses		148,097
Net operating revenue		$57,167
Non-operating revenue		472
Gross corporate income		$57,640
Deductions:		
Non-operating expense	$1,122	
Interest	73,959	
Miscellaneous	1,356	76,437
Deficit for year 1914		$18,797
Balance Dec 31, 1913		3,086
		$15,711
Additions to surplus		22,769
		$7,058
Deductions for year:		
Dividends	$2	
Sinking fund appropriations	10,362	
Other appropriations	8,790	19,154
Deficit Dec. 31, 1914		$12,096

United Gas Improvement Statement.—A comparative statement of the earnings of the United Gas Improvement Company for year ended Dec. 31 is presented herewith. The decrease in earnings from regular sources is accounted for by the falling off in income from the natural-gas properties in Kansas and Missouri. The increase in expenses is due principally to increased taxes and the expense of maintaining the organization of the construction department during a period when very few construction contracts were obtainable:

Earnings:	1914	1913
From regular sources	$6,911,731	$7,142,388
From special sources:		
Extra dividend on stock of one of the companies in which this company is a shareholder	.....	410,000
Profit from sale of securities	2,172,812	1,060,806
Total earnings	$9,084,543	$8,613,194
Expenses	1,188,143	1,142,087
Net profits	$7,896,400	$7,471,107
Dividends	4,440,236	4,440,236
Sinking funds	801,300	790,500
To undivided profit account	$2,654,864	$2,240,371

Western Electric Annual Report.—In the annual report of the Western Electric Company for the year ended Dec. 31, 1914, Mr. H. B. Thayer, the president, states that the business conditions affecting the company's prosperity have been steadily getting worse through the year, and that the prospects for 1915 are not encouraging. The orders on hand on Jan. 1, 1915, were $4,309,000 less in value than on Jan. 1, 1914. The average value of an order filled during 1914 was $56 as compared with $73 for 1913. The number of employees on Jan. 1, 1915, was 15,650 as compared with 19,856 on Jan. 1, 1914. It was further stated that business conditions were reflected in the company's balance sheet by reductions in its merchandise and receivable accounts and by the increase in cash on hand. "It will be impossible," said Mr. Thayer, "until after the close of the European war to report the effect of the war during this year upon our foreign investments. We expect, however, a loss in profit and a certain loss in property, on account of which we may later have to make revaluations." The earnings of the company for the twelve months ended Dec. 31, 1914, follow:

	1914	1913
Sales	$66,408,484	$77,532,860
Other income	948,509	720,556
Total income	$67,356,993	$78,253,416
Manufacturing costs, expenses, etc.	63,323,526	71,689,555
Reserve for contingencies	500,000	2,500,000
Net earnings	$3,533,467	$4,063,861
Fixed charges	862,507	892,166
Excess available for dividends	$2,670,960	$3,171,695
Dividends	1,500,000	1,500,000
Carried to surplus	$1,170,960	$1,671,695

Commonwealth Edison Company Replies to Hogarth Petitions.—Through its attorneys, Messrs. Isham, Lincoln & Beale, Chicago, the Commonwealth Edison Company has filed with the Illinois Public Utilities Commission its reply to the charges made by Mr. J. B. Hogarth attacking the legality of the purchase of the stock of the Chicago Elevated Railways and the issuance of $7,000,000 in 5 per cent notes by the Commonwealth Edison Company. In the reply attention is called to the fact that the commission has no jurisdiction to impose fines or other punishments asked for in the petition. The function of the commission, as pointed out by Mr. Gilbert E. Porter, of counsel, is limited to prosecution of offenders under the criminal laws, for the commission itself cannot assess fines or punishments. Mr. Porter also declared in an interview that the Chicago Elevated Railways Collateral Trust, the body from which the Commonwealth Edison Company directly purchased the Elevated stock, was itself not a utility, since it was made up of three individuals who simply held the Elevated stock in trust. Mr. Porter contends that this body did not constitute a utility any more than individual stockholders of utility properties could themselves be classed as utilities. Mr. Porter further points out that the purchase of Elevated stock complained of occurred in 1911, and therefore prior to the establishment of the commission and the enactment of the utilities law. Concerning the issue by the Edison company of $7,000,000 in 5 per cent notes in payment for the stock, the attorneys aver that since these were one-year notes permission of the commission was not required. Another petition filed by Mr. Hogarth

charges that the Commonwealth Edison Company's domestic rates for electricity in Chicago are unreasonable. After pointing out the complainant's error in stating the rates without the various discounts of 1 cent per kw-hr. for prompt payment, the reply of the company asserts the reasonableness of the rate schedule and cites the fact that the rates charged are in accordance with the Chicago city ordinance provisions of Nov. 26, 1913.

New Jersey Public Service Corporation Report.—The accompanying statement was presented in the sixth annual report of the Public Service Corporation of New Jersey for the year ended Dec. 31, 1914. The growth and development of the electric distribution system of the company is shown by the following statistics for June 1, 1903, and Dec. 31, 1914: Number of poles, in 1903 45,059, in 1914 138,282; miles of wire, in 1903 4244, in 1914 15,080; number of transformers, in 1903 5336, in 1914 18,656; number of meters, in 1903 16,000, in 1914 110,305; total commercial connected load in fifty-watt equivalents, in 1903 710,000, in 1914 4,663,338. The total railway and lighting load for 1903 was 129,614,108 kw-hr. and for 1914 it was 430,818,532 kw-hr.

Operating revenue of subsidiaries		$35,924,453
Operating expenses and taxes	$19,892,708	
Amortization charges	1,303,609	
		21,196,317
Balance		$14,728,136
Non-operating income		351,162
Income from securities and miscellaneous sources		2,484,644
Total		$17,563,942
Income deductions of subsidiary companies		12,097,109
		$5,466,833
Income deductions:		
Interest charges	$3,408,332	
Amortization of debt discount and expense	223,664	
Sinking fund for general mortgage 5 per cent bonds	209,500	
		3,841,496
Net income		$1,625,337
Appropriation accounts of subsidiaries:		
Additional amortization of capital	$2,750	
Amortization of new-business expenditures prior to Jan. 1, 1911	40,330	
Adjustment of surplus account (credit)	103	
		42,977
Balance		$1,582,360
Appropriation accounts of corporation:		
Adjustment of surplus account (credit)		729
Net increase in surplus		$1,583,089

Shawinigan Water & Power Report.—The annual report of the Shawinigan Water & Power Company, Shawinigan Falls, P. Q., for the year ended Dec. 31, 1914, shows that the peak load occurred July 3, when 116,000 electric hp and 38,400 hydraulic hp were supplied. The total output for the year amounted to 431,761,000 kw-hr., an increase of 19.4 per cent over the previous year. The Cedars Rapids Manufacturing & Power Company's development, which was undertaken by this company, and the Montreal Light & Power Company at Cedars Rapids, P. Q., has been put in operation. Mr. J. E. Aldred, the president, stated that the company had a year of unprecedented freedom from interruptions of operation. The provincial government is now in a position to call for tenders for the erection of the dam at Le Loutre Rapids, in connection with the development of the storage reservoir in the headwaters of the St. Maurice. The completion of this development will open to the Shawinigan company the possibility of extensive enlargement of its works and capacity. The company's earnings statement for 1914 follows:

Gross earnings		$1,805,217
Operating expenses	$101,621	
Maintenance and repairs	56,150	
Taxes and insurance	38,381	
General expense	48,443	
Total expenses		244,595
Balance after operation		$1,560,622
Interest on bonds	$250,000	
Interest on debenture stock	245,051	
Interest, general	4,102	
Total		499,153
Net revenue		$1,061,469
Balance from 1913		19,878
Total		$1,081,347
Distributed as follows:		
Dividends		$721,875
Transferred to reserve and sinking funds		200,000
Transferred to contingent fund		20,000
Transferred to depreciation reserve		100,000
Surplus undistributed		$39,472

Manufacturing and Industrial

The Doty Manufacturing Company, Dayton, Ohio, has moved into new quarters on Monument Avenue.

The Monolux Sales Company has moved from 105 West Fortieth Street, New York, to 27 Thames Street, New York.

The C. F. Burgess Laboratories, Madison, Wis., is the name of the firm formerly known as the Northern Chemical Engineering Laboratories.

The Sterling Foundry & Machine Company, 50 Hartford Street, Newark, N. J., is the name of the company formerly known as the C. J. Hartmann Machine Company.

The General Lead Batteries Company, Chapel Street and Lister Avenue, Newark, N. J., is the name of the concern formerly known as the Titan Storage Battery Company of Newark, N. J.

The S K F Ball Bearing Company, 50 Church Street, New York, has appointed Mr. Carlton R. Mabley, for the past five years general manager of the R. I. V. Ball Bearing Company, to a position in its sales department.

Tool Manufacturers' Prize Contest.—The Smith & Hemenway Company, 143 Chambers Street, New York, is offering prizes to manual-training-school students for designs made with its "Red Devil" glass cutters. The contest closes May 31.

Electric Stove Concern Opens Chicago Office.—The Globe Stove & Range Company of Kokomo, Ind., has opened a display room and office at 533 First National Bank Building, Chicago. Mr. M. E. Louth, electrical engineer for the company, is in charge at the new office.

The Electrical Alloy Company, Morristown, N. J., has appointed the Maydwell Company, which has offices at 408 Globe Block, Seattle, Wash., 409 Sheldon Building, San Francisco, Cal., and 822 Central Building, Los Angeles, Cal., as its Pacific Coast representative.

The Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, has recently opened a branch sales office in Cleveland, Ohio. It will be in charge of Mr. Frank H. Hill, manager, who also has charge of the Pittsburgh office. The Cleveland office will be in the Illuminating Building.

Electric-Range Manufacturer Optimistic.—Mr. George A. Hughes, president of the Hughes Electric Heating Company, 211 West Schiller Street, Chicago, Ill., declares that the business of his company is much better than it was a year ago and that he believes that there will be a larger number of sales this year than there were last year.

The Terry Steam Turbine Company, Hartford, Conn., has appointed Mr. A. W. de Revere to take charge of its Chicago office, which is in the People's Gas Building. The company has also opened an office in the Michigan Trust Building, Grand Rapids, Mich., in charge of Mr. A. L. Searles, who will take care of sales in the southern peninsula of Michigan.

Bergoff Brothers & Waddell, Inc., 120 Liberty Street, New York, is a concern which was recently incorporated and which purposes to engage in investigations, secret inquiries, dictagraph service, railway checking, etc. Mr. James A. Waddell of the above firm was formerly president of the Waddell & Mahon Corporation, 200 Fifth Avenue, New York.

Testing Materials.—The Bureau of Standards, Washington, D. C., is distributing a book entitled "The Testing of Materials." It is an eighty-nine-page pamphlet dealing with such subjects as metals and alloys, cements, clay products, rubber, leather, lubricating oils and greases, chemicals, and materials intended for technical use, such as electrical materials, optical materials, etc.

Orders for Electrical Equipment.—Among the orders recently received by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is the following: The United Electric Light & Power Company, New York, one 1000-kva, two-phase, 2100-volt synchronous condenser, with one 27.5-kw directly connected exciter and compound-wound 250-volt motor, three 2000-kva and three 500-kva air-blast transformers of the structural-steel type, eleven 85-kva automatic, single-phase induction regulators, and one twenty-panel switchboard and switching equipment.

The Betts & Betts Corporation, 256 West Fifty-fifth Street, New York, has appointed Mr. Harry A. Yerkes on its staff. Mr. Yerkes is an inventor of electrically operated chimes and bells which are used in amusement places. The above concern is now making various types of chimes and recently has obtained a contract for installing a set in one of New York's prominent restaurants. These chimes are played from an ordinary keyboard, and the bells can be installed at different points throughout the building.

The Usona Manufacturing Company, recently incorporated in the States of New York and Ohio, has opened offices at 1 Hudson Street, New York, and at 309 South St. Clair Street, Toledo, Ohio. The company will manufacture flashlamp cases, battery lanterns, batteries and miniature lamps, which will be designated as the "Kwik-Lite" line. The Usona company has secured the exclusive right to make the Beers lantern. Mr. George G. Beers will be in charge of the New York office, and Mr. Frank Stout, formerly with the Bryant Electric Company, will be sales manager.

The Southwark Foundry & Machine Company, Philadelphia, Pa., has secured the exclusive rights to manufacture the Harris valveless engine in the United States, the operation of the engine being based on the Diesel principle. The engine will be called the Southwark-Harris valveless engine and will be built in sizes ranging from 75 hp to 1000 hp for both marine and stationary service. Mr. Leonard B. Harris, the inventor of the Harris valveless engine, will be employed by the above company as consulting engineer and naval architect. Mr. J. H. Johnston, who has been connected with the development of the above engine, will also be associated with the Southwark company in charge of its oil-engine sales department.

Westinghouse Agent Jobbers Meet.—The second meeting of the year of the Westinghouse Agent Jobbers' Association occurred at the Hotel La Salle, Chicago, March 15 and 16, preceding the meeting of the Electrical Supply Jobbers' Association. Mr. N. G. Harvey, of the Illinois Electric Company, presided, being assisted by Mr. J. J. Gibson, manager of the Westinghouse details and supply department, East Pittsburgh, Pa., who represented Mr. C. L. Nicholson, general sales manager of the company and vice-president of the association, Mr. Nicholson being prevented from attending the conference by illness. More than seventy agents and jobbers attended the sessions, which were occupied with the discussion of sales and distribution methods and plans. *The Triangle,* a house organ which will be issued from time to time by the Westinghouse company for circulation among its agent jobbers, made its first appearance at the meeting.

Orders for Gas Engines.—The following are some recent orders for engines made by the Bruce-Macbeth Engine Company, Cleveland, Ohio: The East Ohio Gas Company, Cleveland, Ohio, two 250-hp and one 90-hp gas engine, directly connected to generators for use in its new office and exhibition building; the Kloss Ice Cream Company, Wheeling, W. Va., one 90-hp four-cylinder natural-gas engine; the McJunkin-Straight Dairy Company, Pittsburgh, Pa., one 150-hp natural-gas engine, including special equipment for generating steam; the Empire Marble Company, Cleveland, Ohio, one 90-hp four-cylinder natural-gas engine; the Broadway Market Company, Detroit, Mich., one 90-hp four-cylinder artificial gas engine; the Magnolia Petroleum Company, Fort Worth, Tex., one 150-hp natural-gas engine; the Alhambra Theater, Sandusky, Ohio, one 40-hp natural-gas engine; the New York Central & Hudson River Railroad Company, one 200-hp gasoline engine to be used on the Calumet River Lift Bridge at South Chicago; the O. Hummel Company, South Carnegie, Pa., one 70-hp natural-gas engine.

New Government Publications.—The superintendent of documents, Washington, D. C., announces that he has for sale at nominal prices the following publications which deal with electrical topics: Census Bulletin No. 124, entitled "Electric Lighting"; the Bureau of Standards technologic paper 18, entitled "Concrete," on electrolysis in concrete; the Bureau of Standards scientific paper No. 235, entitled "Decremeter," on direct-reading instrument for measuring logarithmic decrement and wave-lengths of electromagnet waves; the Bureau of Standards paper No. 233, entitled "Electric Transformers," on the watt-hour-meter method of testing instrument transformers; the Bureau of Standards scientific paper No. 238, entitled "Photometry," on characteristic equations of tungsten-filament lamps and their application in heterochromatic photometry; the Bureau of Standards scientific paper No. 240, entitled "Voltameter," on studies of the silver voltameter. The Bureau of Standards is also distributing free of charge a sixty-eight-page pamphlet entitled "Units of Weight and Measure—Definitions of Tables of Equivalents."

Western Electric Sales Managers' Convention.—An all-week conference of the district managers, sales managers and the general officers of the Western Electric Company was held at the Congress Hotel, Chicago, March 15 to 20, Thursday and Friday being given over to joint sessions with the Electrical Supply Jobbers' Association. The Western Electric meetings were in charge of Mr. Gerard Swope, vice-president and general sales manager. About sixty men, representing all the thirty district offices of the company, were in attendance. On Friday afternoon the Hawthorne works of the company were visited in company with the jobbers, and in the evening a banquet was held at the Blackstone Hotel. Mr. E. W. Rockefellow, assistant general sales manager of the company, expressed the general feeling manifested by the members of the conference that business conditions in the field are generally improving, and declared his own optimism as to the outlook for the coming months of 1915. The sales conference of this week was the first held by the Western Electric Company in four years, the last general assembly of the kind having occurred at Atlantic City in 1911, although a meeting of part of the staff was held at Hot Springs last year.

Market for Electrical Supplies in Greece.—According to Consul John E. Kehl, stationed at Saloniki, Greece, there is a steady increase in the employment of modern methods of lighting shops, cafés, hotels and some of the newer residences, having electrical installations, at Saloniki, and a slight gain is evident in the use of electric bells and private telephones. The European war has brought all local construction work to a standstill, the consul states, and until more normal conditions prevail there will be little opportunity for large sales of electrical materials in this district. This state of affairs, however, should not deter American manufacturers, he asserts, from taking an immediate interest in this market and in bringing their products to the attention of the prospective buyers. Mr. Kehl declares that there will be a demand for telephones and all construction materials, wire and cables, arc lamps, incandescent lamps, ceiling, wall and stand fixtures of inexpensive material, wiring supplies, bell systems, annunciators and novelties designed for direct current and 220 volts or less. Heretofore the local dealers in electrical supplies have imported their goods from Germany, Belgium and Austria-Hungary. No special electrical apparatus is in demand at Saloniki, but some dealers have expressed a desire to place upon the market various types of novelties, such as electric curling irons, toasters, hot-plates and sadirons.

NEW YORK METAL MARKET PRICES

	March 9 — Selling Prices		March 16 — Selling Prices	
	Bid	Asked	Bid	Asked
Copper	£ s d		£ s d	
London, standard spot*	64 7 6		66 0 0	
Prime Lake	14.80		14.85	to 15.00
Electrolytic	14.65		14.70	to 14.90
Casting	14.25		14.12½	to 14.37½
Copper wire base	15.87½		15.87½	
Lead	3.95		4.10	
Nickel	42.00 to 45.00		42.00	to 45.00
Sheet zinc, f.o.b. smelter	13.50		13.50	
Spelter, spot	11.00†		9.62½	
Straits tin	48.50†		52.00†	
Aluminum, 98 to 99 per cent	19.00 to 19.25		19.00	

*OLD METALS

Heavy copper and wire	13.00	13.00
Brass, heavy	9.00	9.00
Brass, light	7.75	7.75
Lead, heavy	3.65	3.65
Zinc, scrap	8.00	7.75

COPPER EXPORTS*

Total tons to March 16.....16,639

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Bethel Township Electric Company, of Bethel, Pa., has been incorporated with a capital stock of $5,000. Henry C. Lucas, of Philadelphia, Pa., is treasurer.

The Concord Township Electric Company, of Concord, Pa., has been granted a charter with a capital stock of $5,000. Henry C. Lucas, of Philadelphia, Pa., is treasurer.

The Edgemont Township Electric Company, of Edgemont, Pa., has been incorporated with a capital stock of $5,000. Henry C. Lucas, of Philadelphia, Pa., is treasurer.

The Birmingham Township Electric Company, of Birmingham, Pa., has been granted a charter with a capital stock of $5,000. Henry C. Lucas, of Philadelphia, Pa., is treasurer.

The Thornbury Township Electric Company, of Thornbury, Pa. (R. F. D., West Chester), has been granted a charter with a capital stock of $5,000. Henry C. Lucas, of Philadelphia, Pa., is treasurer.

The Oswego Lake Water, Light & Power Company, of Oswego, Ore., has been incorporated with a capital stock of $5,000 to install an electric-light plant in Oswego. A. S. Patullo is interested in the company.

The East Earl Electric Light & Power Company, of East Earl, Pa., has been granted a charter to furnish electricity in the township of East Earl. The company is capitalized at $5,000, and the incorporators are George L. Nies, William Sweigart and D. S. Martin.

The Caernarvon Electric Company, of Caernarvon, Pa. (not a post office), has been incorporated with a capital stock of $5,000 to supply electricity for lamps and motors in the township of Caernarvon. The directors are D. S. Martin, treasurer; William Sweigart and George L. Nies.

New Industrial Companies

The Beacon Electrical Engineering & Construction Company, of Buffalo, N. Y., has been incorporated with a capital stock of $10,000 by George E. Hipp, George E. Butler and John E. Hoffman, of Buffalo, N. Y.

Light & Power Supplies, Incorporated, of New York, N. Y., has filed articles of incorporation with a capital stock of $3,600. The incorporators are Sanford Smith, Samuel J. Miller, Raymond W. Bristol and others.

The C. S. Wilmot Company, of Haddon Heights, N. J., has been incorporated with a capital stock of $25,000 to do a general heating, plumbing and electrical business. C. S. Wilmot, of Haddon Heights, is the incorporator.

The Transit Equipment Company, of New York, N. Y., has been incorporated with a capital stock of $5,000 to deal in railway rolling stock, dynamos, pumps, etc. The incorporators are Frank B. Massey and Ernest F. Roehm, 1392 Boston Road, the Bronx, New York, N. Y.

The Novo Manufacturing Company, of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture and deal in electric batteries, novelties, etc. The incorporators are A. C. Robertson, J. H. Gerathy and E. T. Maharin, 49 Morton Street, New York, N. Y.

The General Lighting Fixture Company, of New York, N. Y., has been chartered with a capital stock of $5,000 to deal in lighting, heating and ventilating fixtures, etc. The incorporators are David Eisenstat, Mitchel G. Lubow and Isidor P. Heller, 866 Manida Street, the Bronx, New York, N. Y.

Deuth & Company, of New York, N. Y., have filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general electrical-contracting business and dealing in lamps, machinery and appliances. The incorporators are Victor Steinfield, Eugene J. Deuth and B. Herman, 131 East Fifty-fifth Street, New York, N. Y.

The Motome Electric Company, of New York, N. Y., has been chartered by Christopher A. Shea, Richard D. Wyckoff and Edwin T. Vanderpoel, 60 Broadway, New York, N. Y. The company is capitalized at $100,000, and proposes to do a general electrical contracting work and deal in motors, meters and engines.

Trade Publications

Mica.—The A. O. Schoonmaker Company, 88 Park Place, New York, has issued a booklet which contains price lists on various kinds of mica.

Lightning Arrester.—The Railway & Industrial Engineering Company, Pittsburgh, Pa., is sending out a leaflet which describes the Burke suspension-type lightning arrester.

Battery-Element Puller.—The Commercial Truck Company of America, Philadelphia, Pa., is sending out a folder which describes and illustrates its battery-element puller.

Heating Devices.—The American Electrical Heater Company has recently prepared two illustrated folders which contain information on a number of heating appliances.

Horse-Driven Generator.—The Electric Horsepower Company, 906 Elm Street, Cincinnati, Ohio, is sending out a folder which describes its horse-operated electric generator.

Portable Adjustable Lamp.—The Aladdin Lamp Corporation, 111 Broadway, New York, is distributing an illustrated booklet which describes its portable adjustable electric lamp.

Electric Fly Catcher.—The Vogel Products Manufacturing Company, 1616 Chestnut Street, St. Louis, Mo., is sending out folders which describe its electrically operated fly catchers.

Motor for Operating Rowboats.—Bulletin No. 300 published by the Jewel Electric Company, Chicago, Ill., describes and illustrates a small detachable motor for operating rowboats.

Steel Conduit.—The Sprague Electric Works of the General Electric Company, New York, is sending out a booklet entitled "Greenfielduct," which describes its hot-galvanized steel conduit.

Two-Motor Concentric-Gear Drive Trucks.—Bulletin No. 10 issued by the Commercial Truck Company of America, Philadelphia, Pa., describes a 0.5-ton, two-motor concentric-gear-drive truck.

Vibration Galvanometer.—The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has published Bulletin No. 235, which describes and illustrates its vibration galvanometer.

Electrically Operated Fans.—Booklet No. B-3330 issued by the Sprague Electric Works of the General Electric Company, New York, lists a number of direct-current and alternating-current fans.

Pole-Line Hardware.—Catalog Section ES 846, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., lists various types of accessories for transmission lines.

General Supply Catalog.—The Wesco Supply Company, St. Louis, Mo., has prepared a general supply catalog, designated as No. 200, and Catalog No. 210, which contains information on automobile accessories.

Resistance Wire and Ribbon.—The Electrical Alloy Company, Morristown, N. J., is sending out folders which contain price lists of its "Talido" and "Phenix" wire and its "Ideal" ribbon and German-silver wire.

Electric Trucks.—The General Motors Truck Company, Pontiac, Mich., has issued an attractively illustrated catalog entitled "Municipal Progress," which describes electrically operated trucks for sprinkling and for carrying garbage, and electric patrol wagons, ambulances, etc.

Flashlamps.—The Usona Manufacturing Company. 1 Hudson Street, New York, has issued an attractively illustrated thirty-one-page catalog which describes a number of battery-operated lamps called the "Kwik-lite" products. A lantern formerly made by the Beers Sales Company of Bridgeport, Conn., which the above concern has absorbed, is included in these products.

Electric Apparatus.—The British Thomson-Houston Company, Ltd., Rugby, England, has prepared a bulletin designated as Descriptive List No. 2216, which describes its type DR direct-current generators; Price List No. 2256, which contains information on its type DR direct-current motor; Price List No. 4503, which contains information on its lightning arresters for alternating-current circuits, and Price List No. 5801, which describes and illustrates its alternating-current brake magnets.

Construction News

New England

PORTLAND, MAINE.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 20 for the construction, including mechanical equipment, lighting fixtures and grading, of the steerage barracks and storehouse for the United States quarantine station at Portland, Maine. Drawings and specifications may be obtained from the above office or from the custodian at the quarantine station.

WINDSOR, VT.—The Windsor El. Lt. Co. expects to place contracts for one open heater and purifier, and possibly for a steam turbine-driven exciter and feed pump. The company has recently contracted for one 325-hp Ames-Stumpf engine, to be in operation June 15, and one 250-kva Allis-Chalmers three-phase, 60-cycle engine-type generator. One 150-hp Heine boiler with shaking grates has been installed; also complete new steam-pipe system. Richard P. Osgood is superintendent.

BROCKTON, MASS.—The Edison El. Illg. Co., of Brockton, is contemplating building a substation in the northern part of the city and erecting two transmission lines from Brockton to North Easton.

GREENFIELD, MASS.—The name of the Amherst Pwr. Co. has been changed to the Turners Falls Pwr. & El. Co. George W. Lawrence is general manager.

MARLBORO, MASS.—The Marlboro El. Co. is planning to extend its transmission line on the Boston Road, a distance of about 3 miles.

NORTH ATTLEBORO, MASS.—The town officials are considering extending the street and commercial lighting districts.

WEBSTER, MASS.—The proposal to install an ornamental street-lighting system in Webster will be submitted to the voters at the next annual town meeting. The plans provide for the erection of 31 luminous-arc lamps in the business district.

PROVIDENCE, R. I.—Bids will be received at the office of the Board of Contract and Supply, City Hall, Providence, until March 22 for electric wiring and electric fixtures for the new addition to the City Hall building. Specifications may be obtained at the office of the public service engineer, City Hall. Joseph H. Gainer is Mayor.

DANBURY, CONN.—The Danbury & Bethel Gas & El. Lt. Co. is planning to extend its transmission line from its present terminus at Beaver Brook Chapel to the plant of the Stearns Lime Co., near Brookfield, a distance of 2 miles, to furnish energy to operate the lime plant. The company will also furnish electrical service to residents along the line.

NEW HAVEN, CONN.—Bids will be received at the office of the city engineer, No. 17, City Hall, New Haven, Conn., until March 25 for installing electrical equipment and machinery for operating the gates of the Chapel Street drawbridge electrically. Blank forms of proposal, specifications, etc., can be obtained upon application to the above office. F. L. Ford is city engineer.

Middle Atlantic

DELHI, N. Y.—Bids will be received by William H. Maynard, president of the board of control, State School of Agriculture and Domestic Science, at the office of the county clerk, Delhi, N. Y., until March 26, for construction, heating, plumbing, drainage and electric work for dairy building for the State School of Agriculture and Domestic Science at Delhi. Drawings and specifications may be obtained at the Department of Architecture, Capitol, Albany, upon deposit of $10 for each set of plans, to be refunded upon return of same.

LA FARGEVILLE, N. Y.—The local electric-light plant, owned by Clinton Gillette, was recently destroyed by fire, causing a loss of about $3,000. The town is at present without electrical service.

NEWARK, N. Y.—Plans are being considered for extensions to the street-lighting system, for which an appropriation of $15,000 has been made.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 24 for remodeling the fire-alarm system at the navy yard, New York. Specifications may be obtained on application to the bureau or to the commandant of the navy yard named.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, 2351 Municipal Building, New York, until March 25, for the following supplies: Bearing alloy, belt lacing, boiler tubes, electrical supplies, gaskets, etc. Blank forms of proposals, including specifications, may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, 2351 Municipal Building, New York, until March 24, for furnishing nine 1½-ton motor trucks with bodies and other appurtenances complete. Blank forms of proposals and contract, including specifications, may be obtained at the above office.

PAWLING, N. Y.—Preparations are being made by Ralph A. Griffing, who was recently granted a franchise to install and operate an electric-lighting plant in Pawling. Electricity for operating the system will be obtained from the plant of the Housatonic Pwr. Co. at Bull's Bridge, Conn. The plans provide for the erection of a 11,000-volt transmission line from Bull's Bridge to Pawling, 10 miles long; also a branch line from Pawling to Quaker Hill.

WATERVLIET, N. Y.—The City Council is considering the advisability of abandoning the municipal electric-light plant and entering into a contract with the Adirondack El. Pwr. Corpn., of Glens Falls, for lighting the streets of the city.

WELLSBURG, N. Y.—The Public Service Commission has granted the Elmira Transmission Corpn., of Elmira, permission to exercise a franchise given the company to supply electricity in Wellsburg.

WELLSVILLE, N. Y.—The Wellsville El. Lt., Ht. & Pwr. Co., it is reported, has accepted the offer of the village to purchase its plant. The lighting system will be remodeled after plans prepared by H. B. Sweet, of Utica, consulting engineer.

WEST WINFIELD, N. Y.—The Public Service Commission has approved the franchises granted by the village of West Winfield to Charles G. and Lewis B. Senif (copartners) to supply electricity here.

WHITNEY POINT, N. Y.—Within the next three months the Union El. Co., of Whitney Point, expects to purchase generator, waterwheel and waterwheel governor. D. O'Donnell is president.

ALLENTOWN, PA.—The City Council, it is understood, will soon ask for bids for an electrically operated pump of about 5,000,000-gal. capacity for the water-works system. Electricity for operating the pumping station will be supplied by the Lehigh Valley Lt. & Pwr. Co., of Allentown. Charles Blazer is engineer of the Water Department.

BROWNSVILLE, PA.—Surveys, it is reported, are being made for the H. C. Frick Coke Co. with a view of securing options on power sites along the Monongahela River. A power plant, it is understood, will be erected with sufficient output to supply electricity to the numerous plants owned and operated by the H. C. Frick Coke Co.

EASTON, PA.—A large seven-story-and-basement department-store building will be erected by William Laubach & Sons, Inc., in Easton. The plans, it is said, provide for an extensive electrical equipment.

EBENSBURG, PA.—The Penn Central Lt. & Pwr. Co., of Ebensburg, has decided to make improvement to its system, involving a large expenditure of money. The company supplies electrical service from Lewistown on the east to Twin Rocks, Cambria County, on the west, and Kinport, Clearfield County, on the northwest.

EVERETT, PA.—A movement has been started by the citizens of Everett for the installation of a municipal electric-light plant. The Everett Lt., Ht. & Pwr. Co. furnishes electrical service in this town.

NORRISTOWN, PA.—The Counties Gas & El. Co., of Norristown, is contemplating the installation of a 2500-kw turbo-generator set, condenser, pumps and auxiliary equipment, 500-hp boiler, new smokestack (brick), necessary piping, etc. The company is erecting 15 miles of 13,000-volt transmission line and will also make extensions to its distributing system.

PITTSBURGH, PA.—Bids will be received at the United States Engineer Office, Pittsburgh, Pa., until April 3 for furnishing engines and electric-light plants, etc., for maneuver boats at dams Nos. 10 and 29, Ohio River. Further information may be obtained upon application to Harold C. Fiske, captain engineers.

PITTSBURGH, PA.—Bids will be received at the United States Engineer Office, Pittsburgh, Pa., until April 5 for construction of a fireproof power station, furnishing and installing one 115-hp boiler, one 15-hp boiler, one steam-driven air compressor and two air receivers, piping and accessories, and furnishing one feed-water heater and one service-water pump at dam No. 10, Ohio River. Further information can be obtained upon application to Harold C. Fiske, captain engineers.

READING, PA.—The City Council has awarded the contract for street-lighting to the Metropolitan El. Co., of Reading, for a period of five years. Under the terms of the contract the company is to place all overhead wires in the City Park under ground.

SOUTH CONNELLSVILLE, PA.—The West Penn El. Co., of Pittsburgh, is contemplating extending its lighting service to South Connellsville.

PHILLIPSBURG, N. J.—The installation of an ornamental street-lighting system in the business district, consisting of about 77 standards, is under consideration by the City Commissioners. The cost is estimated at about $7,500.

WILMINGTON, DEL.—The Board of Street and Sewer Directors has awarded the contract for lighting the streets of the city to the Wilmington & Philadelphia Trac. Co., of Wilmington, for a period of five years.

BALTIMORE, MD.—Plans have been completed by Charles L. Reeder, consulting engineer, for improvements and additions to the power plant and laundry of the Hebrew Hospital. The improvements will include an addition to power house, installation of new boilers, engines and electrical equipment, laundry machinery, etc.

BALTIMORE, MD.—The proposed addition to the municipal electric-light plant, which is installed in the high-pressure pumping station on South Street, will consist of one 500-kw turbo-generating unit, three-wire type, bids for which have already been received. In connection with furnishing and installing the new unit the specifications call for an independent exhaust line, the removing of the 125-kw turbo-generators, which are at present installed in the basement, to the first floor, alongside of the new outfit; also moving the switchboard from the basement to the first floor and connecting it with the new board. Bids have not yet been awarded. Lester L. Kingsbury is chief electrical inspector.

JEFFERSON, MD.—The Hagerstown & Frederick Ry. Co., of Hagerstown, it is reported, is considering extending its electric-lighting system to Jefferson.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent, Post Office Department, Washington, D. C., until March 22 for furnishing and installing a fire-alarm gong system in the Post Office Department annex building. For further information address J. A. Edgerton, purchasing agent.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 30 for furnishing at the various navy yards and naval stations supplies as follows: Boston, Brooklyn, Norfolk and Charleston, Schedule 8026—40 steel-plate fans and convertible blowers. Norfolk, Va., Schedule 8037—1000 lb. hydraulic leather; Schedule 8039—1000 lb. ingot aluminum; Schedule 8043—miscellaneous seamless drawn-brass pipe, 1100 lb. seamless drawn-copper pipe, Key West, Fla., Schedule 8027—taking down of miscellaneous radio masts. Brooklyn, N. Y., Schedule 8044—eight simplex feed pumps; Schedule 8043—miscellaneous seamless drawn-copper tubing, 1470 composition unions. Washington, D. C., Schedule 8031—300 self-locking grease cups. Newport, R. I., Schedule 8032—600 lb. soft sheet copper, 500 lb. phosphor-bronze tubing, miscellaneous annealed copper tubing. Boston, Mass., Schedule 8043—4000 lb. tubing for condenser ferrules. Bids will be received at the same place until April 6 as follows: Mare Island, Cal., Schedule 8020—for two 25-kw turbo-generators; Schedule 8019—one vertical simplex pump. Brooklyn, N. Y., Schedule 8028—for six 2-kw radio sets. Philadelphia, Pa., Schedule 8030—miscellaneous tool carbon steel and tungsten tool steel. Schedule 8064—12 circuit-breakers, 12 double-pole switches, miscellaneous voltmeters, ammeters, frequency meters and wattmeters. Brooklyn, N. Y., Schedule 8060—1500 ft. three-cable conductor, miscellaneous three-wire conductor; Schedule 8064—miscellaneous 1-hp drum-type motors; Schedule 8074—miscellaneous copper bar; Schedule 8075—miscellaneous seamless drawn-brass pipe; Schedule 8062—12,000 lb. sheathing copper. Washington, D. C., Schedule 8061—one ¼-hp shunt-wound motor. Brooklyn, N. Y., and Norfolk, Va., 8074—miscellaneous brass bar. Portsmouth, N. H., Schedule 8071—3000 lb. sheet-copper braziers. Boston, Mass., Schedule 8075—miscellaneous seamless-drawn copper pipe and 57,500 lb. admiralty mixture condenser tubes. Bids will also be received until April 13 at the same place for the following supplies: Brooklyn, N. Y., and Charleston, S. C., Schedule 8067—miscellaneous conduit steel and miscellaneous fuse wire. Charleston, S. C., Schedule 8067—10 annunciators,

water-tight type and miscellaneous rosin-cored solder wire. Puget Sound, Wash., Schedule 8077—miscellaneous sheathing copper; Schedule 8078—miscellaneous seamless-drawn brass pipe. Mare Island, Cal., Schedule 8067—miscellaneous globes and reflectors, 100 shade holders, miscellaneous resistance wire. Brooklyn, N. Y., Schedule 8067—miscellaneous ammeters and voltmeters, miscellaneous material for switchboard panels. East and West, Schedule 8067—miscellaneous vibrating bells and buzzers, push-buttons, red and gray sheet fiber, electrical fittings, glass tube fuses, inclosed cartridge-type fuses, portable guards (N. W. T.), miscellaneous electric flatirons, pressed-plate mica, hard sheet rubber, miscellaneous portable ventilating sets, East, Schedule 8067—miscellaneous hard-rubber bushings, interior fittings, electric soldering irons, lamp sockets, single and three-pole switches, electric, etc., linen tape. Philadelphia, Pa., and Norfolk, Va., Schedule 8067—miscellaneous renewable fuses. Charleston, S. C., Philadelphia, Pa., Schedule 8067—miscellaneous terminal tubes. Boston, Mass., and Mare Island, Cal., Schedule 8067—miscellaneous magnet wire. Bids will also be received until April 20 as follows: Pensacola, Fla., Schedule 8058—one dirigible, vedette type, complete with power-plant equipment and outfit. Puget Sound, Wash., Schedule 8065—one electrically driven derrick hoist. Applications for proposals should give the schedule desired by number.

North Central

ALPENA, MICH.—Preparations are being made for extensions to the ornamental street-lighting system. The present plans provide for the erection of 75 lamp standards, and for 400-cp series Mazda lamps, to be maintained by underground wires, and to cost approximately $7,955. Contracts for the works have not yet been awarded. Frank Blaske is chairman of lighting committee, and A. C. Calkins superintendent of the municipal electric-light plant.

BELDING, MICH.—Within the next three months the Citizens' Lt. Co., of Belding, expects to purchase a car load of cedar poles. M. A. Reed is secretary.

FLINT, MICH.—Bids will be received by A. J. Wildanger, secretary of the Union School District, Flint, Mich., until April 1, for construction of the new Fairview school building, separate bids to be submitted as follows: (1) Heating and ventilating; (2) plumbing; (3) electric wiring; (4) general contract, including all work and material not included in other proposals. Plans and specifications may be obtained upon application to Malcomson & Higginbotham, 404 Moffatt Building, Detroit, or to A. J. Wildanger, secretary, Flint, upon payment of $10, to be refunded upon return of same.

GREENVILLE, MICH.—Local business men are considering the question of installing an ornamental street-lighting system on Lafayette Street.

HOLLAND, MICH.—Plans are being considered by the Board of Public Works for the construction of a new power house (to cost about $25,000) for the municipal electric-light plant to replace the present building on East Fifth Street.

CINCINNATI, OHIO.—Application will be made to the City Council by Walter H. Hutzler, 116 West Elder Street, and other business men for a franchise to operate a block electric-light plant in the vicinity of Findlay Market. It is proposed to install a steam-driven electric plant, for which $50,000 has already been subscribed.

CINCINNATI, OHIO.—The ten-story office building to be constructed by Val Duttenhofer, Jr., S. S. and G. H. Godley, architects, at a cost of $185,000, will be equipped with a vacuum cleaner system, four electric elevators, an ice plant and other equipment involving electrical appliances. The Roche-Bruner Building Co., of Cincinnati, has the general contract.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until March 26, for transformers for the municipal electric-light department, specifications for which may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street. A. R. Callow is commissioner of purchases and supplies.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until April 1, for the construction of the East Seventy-ninth Street substation for the municipal electric-light department in accordance with specifications which may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street. A. R. Callow is commissioner of purchases and supplies.

MANSFIELD, OHIO.—Plans are being prepared for the installation of a new street-lighting system in Mansfield, to cost about $50,000. The plans provide for 225 ornamental lamps in the business district. H. Whitford Jones, Citizens' Building, Cleveland, is engineer.

MILFORD CENTER, OHIO—Within the next three months the Union Lt. & Wtr. Co. expects to purchase 50 meters, one 5-kw transformer and one 10-hp alternating-current motor. M. H. Dea is manager.

NAPOLEON, OHIO.—Within the next three months the Board of Trustees expects to purchase one 500-kw steam-driven generating unit (type not yet decided upon) and ornamental (post) lighting system for the business section of the city; also to install a water purification and filtration plant of approximately 2,000,000-gal. capacity, with new low-service and high-service pumps. William G. Clark, of Toledo, is engineer for filtration plant. D. A. Hull is superintendent of municipal electric-light plant and water-works system.

NORTH BALTIMORE, OHIO.—The North Baltimore Service Co. expects to erect within the next three months a 2500-volt, 60-cycle transmission line between North Baltimore and Hoytville, a distance of 6 miles; also to install a distributing system and street-lighting circuit in Hoytville.

PEEBLES, OHIO.—Plans are being considered for the installation of a municipal electric-lighting plant in Peebles, for which $11,500 in bonds have been issued.

EARLINGTON, KY.—The St. Bernard Mining Co., of Earlington, expects to purchase material for distribution and lighting system and some electrical appliances and supplies to meet regular requirements. Frank D. Rash is vice-president and general manager.

EMMA, KY.—The Floyd Mining Co., of Emma, will erect a small electric plant in Woods, near Emma, with sufficient output to maintain eight or ten street lamps and to operate the machinery in the mines. The equipment will consist of a small boiler, engine, generator and switchboard for same; about 4000 ft. of wire will be required. Henry L. Coe is manager.

FRANKFORT, KY.—The City Council is considering the question of establishing a municipal electric-lighting plant.

NEW HAVEN, KY.—Robert A. Greenwell, who has been engaged as manager of the municipal electric-light plant, will superintend the construction of power house and installation of machinery.

OWENTON, KY.—Within the next six months W. E. Arnold, owner of the local electric-lighting plant, expects to purchase one oil engine with a rating of about 30 hp.

DIXON, ILL.—The Illinois Northern Utilities Co., of Dixon, has decided to erect a high-tension transmission line from Marengo to Harvard. When the line is completed the plant in Harvard will be closed down. The company is also contemplating extending the transmission to Walworth and Fontana during the coming summer, but has not yet decided definitely.

WATERTOWN, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, Ill., until March 29 for furnishing one steam boiler and equipment, including stoker, breeching, piping, etc., for the power plant of the Water State Hospital, Watertown. Specifications may be obtained upon application to Dr. J. A. Campbell, of Watertown, managing officer.

ASHLAND, WIS.—The Board of Supervisors of Ashland County, it is reported, has engaged Vaughn, Meyer & Sweet, Majestic Building, Milwaukee, Wis., consulting engineers, to prepare plans and award contracts for all electrical work and fixtures for the new court house now under construction. The cost of the building is estimated at $275,000.

FLORENCE, WIS.—The Florence Water and Light Commission expects to erect a new street-lighting circuit during the coming summer. E. E. Wilcox is president.

FRIENDSHIP, WIS.—The Friendship El. Lt. & Pwr. Co. expects to purchase a generator, one waterwheel governor, flywheel and belt; also 100 poles, three transformers, six pair of lightning arresters, 32 meters, 100 lb. wire, 300 incandescent lamps, three washing machines and 25 flatirons. George Polivka is president.

GRAFTON, WIS.—Within the next six months the Grafton Lt., Ht. & Pwr. Co. expects to erect several miles of transmission lines. August Kroehuke is secretary.

GREEN BAY, WIS.—The Wisconsin Pub. Ser. Co., of Green Bay, is contemplating the erection of a 15,000 or 26,000-volt transmission line from Wrightstown to Kaukauna, and extension of a 2300-volt, three-phase transmission line to and erection of distribution system in Greenleaf.

HUDSON, WIS.—The Burkhardt Milling & El. Pwr. Co., of Hudson, expects to erect within the next three months 15 miles of 13,200-volt, three-phase, 60-cycle transmission line; also to purchase pole-line switches and outside substation equipment and lightning protection; also to purchase within the next two months 13,200/2200-volt transformers and 2200/110-220-volt transformers and small 6.6-amp series automatic street-lighting circuits for 60-cycle alternating-current service. The company also expects to purchase within the next three months electrical cooking apparatus, etc. H. E. Zimmerman is superintendent.

HUSTIFORD, WIS.—Within the next five or six months the Hustiford Lt., Pwr. & Mfg. Co. expects to erect from 4 to 5 miles of transmission line; also to purchase within three or six months seven or eight transformers, and within the next 12 months one voltage regulator. W. H. Rohrschneider is secretary and manager.

JANESVILLE, WIS.—The Janesville El. Co. expects to rebuild its power house at Indian Ford, destroyed by fire on Feb. 23, at once; also to purchase a 200-kva, 2300-volt generator. P. H. Korst is secretary.

JEFFERSON, WIS.—The Electric Light and Water Commissioners expect to purchase within the next four months one or more electrically driven pumps and a new switchboard (2200 volts); also within the next six months to purchase material for 2 miles of pole line and for an ornamental street-lighting system for about eight city blocks. John J. Angel is superintendent.

LOMIRA, WIS.—The Lomira El. Lt. & Pwr. Co. expects to purchase within the next six months 10 meters, several washing machines, flatirons and some wiring supplies. W. J. Watts is secretary.

MEDFORD, WIS.—The Medford Lt. & Htg. Co expects to erect within the next six months a new power house and new equipment with generating capacity of 300 kva William Ungrodt is superintendent.

MERRILL, WIS.—Within the next six months the Merrill Ry. & Ltg. Co. may purchase some steel poles, from 30 ft. to 35 ft. long. E. S. King is secretary.

MERRILLAN, WIS.—The village of Merrillan expects to purchase within the next two months poles and cross-arms to rebuild some of the lines of the municipal electric-lighting plant. W. D. Cook is superintendent.

POYNETTE, WIS.—The Poynette El. Co. has been granted a franchise to construct and operate an electric-lighting plant in Poynette. Water rights, it is understood, have been secured for the proposed plant.

VIOLA, WIS.—Within the next three months the Viola Lt. & Pwr. Co., expects to purchase one 100-kw or 125-kw, three-phase, 60-cycle, 2300-volt generator directly connected to waterwheel.

CHISHOLM, MINN.—Plans have been prepared by the Chisholm El. Co. for the construction of a new power plant and extensions to its system, to cost about $50,000.

HIBBING, MINN.—Burns & McDonnell, consulting engineers, of Kansas City, Mo., engaged by the Water and Light Board of Hibbing to make investigation of the municipal electric-light plant and water-works system, have recommended improvements that will cost from $100,000 to $157,000.

PELICAN RAPIDS, MINN.—Within the next few months the managers of the municipal electric-lighting plant expect to purchase some cable for underground service and possibly some electric stoves. H. E. Stevens is superintendent.

TWO HARBORS, MINN.—The City Council is considering the question of extending the transmission lines of the municipal electric-lighting system to the west city limits to supply electrical service in that vicinity.

AMES, IA.—Bids will be received by A. B. Maxwell, city clerk, Ames, until April 5, for the erection of a two-story and basement city hall building, including heating, plumbing and electric wiring. Separate bids to be submitted for heating, plumbing and electric wiring. Plans and specifications may be obtained from the city clerk or from Liebbe, Nourse & Rasmussen, architects, 514 Utica Building, Des Moines, Ia., upon deposit of $10, which will be refunded upon return of same.

CENTER JUNCTION, IA.—The Council is reported to be negotiating with the Iowa River Lt. & Pwr. Co., of Eldora, to extend its transmission lines to Center Junction to furnish electrical service here.

THURMAN, IA.—The Thurman El. Co., recently incorporated, has taken over the plant and business of the Thurman Lt. & Pwr. Co. H. McCartney is manager.

NOVINGER, MO.—Within the next three months the Merchants' Lt. & Pwr. Co., of Novinger, expects to build a new boiler room and to purchase one 100-hp boiler. J. F. Duncan is manager.

ODESSA, MO.—The Board of Public Works expects to purchase soon some electrical appliances and supplies, including motors, washing machines, vacuum cleaners, cooking apparatus, etc. J. G. Lightner is manager and purchasing agent.

ST. LOUIS, MO.—The Lt. & Devel. Co., of St. Louis, expects to purchase within the next two months one 500-hp oil engine and generator. H. W. Beck is secretary.

SARCOXIE, MO.—The Sarcoxie El. Lt. & Milling Co. expects to purchase within the next six months poles, cross-arms and lamps. H. S. Reynolds is secretary and manager.

STOUTSVILLE, MO.—Plans are being considered by the Stoutsville Garage Co. for the installation of a small electric-light plant to supply electricity in Stoutsville.

SWEET SPRINGS, MO.—The city of Sweet Springs expects to purchase within the next six months one 50-hp or 60-hp crude-oil engine and a 37½-kw or 45-kw, three-phase alternating-current generator for the municipal electric-lighting plant. J. J. Smith is superintendent.

WINFIELD, MO.—Negotiations are under way with a view of making arrangements to have the towns of Winfield, Foley and Old Monroe co-operate in connection with the construction of an electric-lighting plant and ice factory to supply service to the three towns. It is understood that energy to operate the system will be obtained from the North Missouri Lt. & Pwr. Co., of New London.

BELFIELD, N. D.—The Beach El. Co., of Beach, has applied to the Village Council for a franchise to construct and operate an electric-light system in Belfield.

OLDHAM, S. D.—Within the next six months the Board of Trustees expects to purchase a 65-volt, 225-amp-hr. chloride accumulator or storage battery; also within the next three months to purchase ten 57-volt direct-current watt-hour meters and five 50-amp meters. C. G. Engstrom is manager.

EDGAR, NEB.—Bonds to the amount of $13,500 have been voted for the installation of a municipal electric-light plant. V. S. Hollister, of Lincoln, Neb., is engineer in charge.

SEWARD, NEB.—Within the next six months the Blue River Power Co., of Seward, expects to purchase waterwheels, generator, transformers and other station apparatus. Burdette Boyes is secretary.

STANTON, NEB.—Within the next two months the city of Stanton expects to purchase one 100-hp boiler and a 50-hp steam engine to carry the light load. The city also has for sale or exchange a 100-hp Fairbanks-Morse producer-gas outfit (in good condition). John Schindler is water and light commissioner.

MOUND CITY, KAN.—The installation of a municipal electric-light plant in Mound City is under consideration.

OSAWATOMIE, KAN.—New equipment will be installed in the municipal electric-light and water-works plant, consisting of two centrifugal pumps, one 150-hp boiler, one 125-hp engine and one 100-kw alternating-current generator; one 150,000-gal. tank and tower will be built and 12,000 ft. of 4-in. 6-in., 8-in. and 10-in. water mains will be laid. Bids for the above work were received March 16. Worley & Black, Kansas City, Mo., are the engineers. B. L. Prier is superintendent.

Southern States

MAXTON, N. C.—The Carolina El. Co., of Maxton, is erecting a power house at Whiteville. Equipment for the plant and transmission line has been purchased. H. C. McNair is president.

ORANGEBURG, S. C.—The City Council is considering issuing $30,000 in bonds for improvements to the electric-lighting plant and water-works system.

WESTMINSTER, S. C.—Bonds to the amount of $16,000 have been authorized by the Town Council for the installation of a municipal electric-light plant.

WINNSBORO, S C.—Bids will be received by the J. B. McCrary Co., engineers, at the office of T. A. Moore, clerk of joint commissioners, Winnsboro, N C., until March 23, for furnishing all material and machinery for water-works and sewerage systems and improvements to electric-light plant as follows: One 72-in. by 16-in. boiler, one 180-hp four-valve engine, one 125-kva generator, one three-panel switchboard, two 750-gal.-per-minute Underwriters' steam fire pumps, one 250-gal.-per-minute centrifugal pump and a 25-hp motor, two 300-gal.-per-minute centrifugal pumps and 25-hp motors, five 15-kw transformers, one 75,000-gal. tank on 75-ft. tower, one 250-hp open-type feed-water heater, one 6-in. by 4-in. by 6-in. feed pump, and miscellaneous cast-iron pipe, gate valves and boxes, sewer pipe, manholes, etc. Specifications may be obtained at the office of the J. B. McCrary Co., Third National Bank Building, Atlanta, Ga.

JEFFERSON, GA.—Bids will be received by the city of Jefferson until April 19 for hydraulic and mechanical equipment and appurtenances as follows: One 50-hp gasoline engine, one 37½-kw, three-phase, 60-cycle generator (belted), one switchboard panel and appurtenances, one 350-gal.-per-minute, motor-driven centrifugal pump under 50-ft. head, one 350-gal.-per-minute centrifugal pump, under 250-ft. head. The Solomon-Norcross Co., of Atlanta, has charge of the engineering work. J. N. Holden is Mayor.

NASHVILLE, TENN.—The City Council is considering the installation of new boilers in the municipal electric-light plant, to cost about $40,000. W. W. Southgate is city engineer.

LONOKE, ARK.—The City Council has awarded a contract to the Lonoke Lt. & Wtr. Co. to install an electric street-lighting system in Lonoke.

ABBEVILLE, LA.—Plans are being considered for the installation of an ornamental street-lighting system, extending from the Place Madeleine to the Court House Square. Ornamental standards carrying five-lamp clusters will be erected.

WHITE CASTLE, LA.—The City Council is considering the question of installing a municipal electric-light plant in White Castle.

JENNINGS, OKLA.—Plans are being considered by the Oil Belt Terminal R. R. Co., of Jennings, for the construction of a hydroelectric power plant on Lagoon Creek, about midway between Oilton and Jennings.

LAWTON, OKLA.—The Comanche Lt. & Pwr. Co., of Lawton, has applied for a 25-year franchise to supply electricity in this city.

WALTER, OKLA.—The town of Walter has abandoned the proposal to install a municipal electric plant and is negotiating with the Comanche Lt. & Pwr. Co., of Lawton, to furnish electrical service here.

WOODVILLE, OKLA.—The City Council is contemplating submitting the proposal to establish a municipal electric-lighting system in Woodville to the voters.

YALE, OKLA.—The contract for construction of the municipal electric-light plant and extensions to water-works system has been awarded to the Reinhart-Donovan Co., of Oklahoma City. The equipment will consist of one 75-hp engine, one 50-kva generator, a 25-hp motor, one centrifugal pump of 360,000-gal. capacity, one filter, pipe and pole lines, and street-lighting system, consisting of 28 lamps, and service lines.

AUSTIN, TEX.—A bill has been introduced into the State Legislature providing for an expenditure of about $350,000 for renovating and rehabilitating the interior of the State House. Among the improvements contemplated is the installation of an entirely new heating and electrical plant, including a new power house. An immediate appropriation of $1,200 is asked to permit the employment of an architect and engineer to prepare plans for the proposed improvements.

SAN ANGELO, TEX. — Extensive changes are being made to the auxiliary equipment of the San Angelo Wtr., Lt. & Pwr. Co., which will require several months to complete. Ralph J. Irvine is general manager.

VINTON, TEX.—Plans, it is reported, are being prepared by the Vinton Ice, Lt. & Pwr. Co. for the construction of an electric-lighting plant and ice factory in Vinton.

Pacific States

ELLENSBURG, WASH.—The City Council has instructed City Engineer Carter to prepare plans for an auxiliary steam plant, to be operated in conjunction with the municipal electric-light plant, to cost about $60,000. Bids for machinery and construction, it is understood, will be asked for soon.

KELSO, WASH.—The City Council and the Washington-Oregon Corpn. have entered into an agreement whereby improvements and changes will be made to the street-lighting system in Kelso. The plans provide for installing 60-watt Mazda lamps throughout the residence districts, to replace the present 32-cp lamps, and 100-watt and 200-watt lamps to be substituted for the arc lamps now in use.

RIVERSIDE, WASH.—Application has been made to the County Commissioners by the Mutual El. Lt. & Pwr. Co., of Riverside, for a franchise to erect a transmission line along the right-of-way of the White and Stuck River improvement project. Lorenzo Dow is interested in the company.

SULTAN, WASH.—Within the next 12 months the Sultan El. Co. expects to erect 10 miles of transmission line and to purchase within the next six months station and pole-type lightning arresters for 2200/6600-volt alternating-current transmission line. F. I. Anderson is secretary and manager.

EUGENE, ORE.—During the coming year the Eugene Water Board may require material for extensions to lighting system, amounting to $10,000. C. W. Geller is secretary and acting general superintendent.

DRUMMOND, MONT.—The Royal Basin Mining & Milling Co., of Maxville, is planning to extend its electric transmission line to Drummond and Hall.

MELSTONE, MONT.—J. C. Woodward, of the Republic Coal Co., has applied to the City Council for a franchise to install and operate an electric-lighting system in Melstone.

PUEBLO, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co., of Pueblo, will rebuild approximately 40 miles of transmission line between Pueblo and Skaguay hydroelectric station, consisting principally of re-insulating line, using approximately 5000 high-tension insulators and pins. The company is extending its local service about 2½ miles to a dairy district to provide electricity for lamps and motors. It also has contracts for approximately 1000 hp (new business) in the Cripple Creek gold-mining district. To serve this it will require additional distributing lines, high-tension transformers, lightning arresters, etc., most of which have already been purchased. The company may extend its transmission line to several additional villages in the Arkansas Valley this season.

Canada

NANAIMO, B. C.—The Nanaimo El. Lt., Pwr. & Ht. Co. expects to purchase within the next six months a 50-lamp (magnetite) street-lighting outfit. W. Lewis is manager.

THE PAS, MAN.—Plans have been prepared by W. E. Cox, of Winnipeg, for the lighting and heating plant for The Pas terminals of the Hudson Bay Railway, to cost approximately $35,000.

DUTTON, ONT.—The ratepayers on March 8 voted in favor of by-laws authorizing the village to contract with the Hydro-Electric Power Commission of Ontario for power and also authorizing an expenditure of $10,000 for the installation of the system. The municipality will be supplied by a low-tension transmission line from St. Thomas.

FORMOSA, ONT.—A company has been organized under the name of the Formosa El. Lt. Co. to erect a transmission line to connect with the lines of the Walkerton El. Lt. & Pwr. Co. at Mildmay. F. A. Heinz is president of the company.

GALT, ONT.—The Toronto Suburban Ry. Co., Toronto, has taken out a permit for the erection of a new transformer station in Galt.

MONTREAL, QUE.—Plans and specifications have been prepared by A. Parent, lighting superintendent, for an ornamental lighting system on St. Catherine and Bleury Streets. The plans provide for 142 standards on the former thoroughfare and 45 on the latter. The standards will be 14½ ft. high, and each will be mounted with a single lamp. An appropriation of $40,000 has been made for improving the civic street-lighting system.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until March 30 for furnishing steel reinforcing bars, steel cable, pipe fittings, copper sheathing, engine lubricators, starting compensator for motor, etc. Blanks and general information pertaining to this circular (No. 906) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 9, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,130,697. Automatic Telephone-Exchange System for Subscribers' Lines with Extension Sets; F. Aldendorff, Antwerp, Belgium. App. filed Sept. 4, 1913. Special arrangement of final selectors.

1,130,706. Railway Signal System; R. B. Bryant, Little Rock, Ark. App. filed Nov. 20, 1908. For electric single track.

1,130,710. Electric Battery; H. Csanyi, New York, N. Y. App. filed Nov. 3, 1913. Sealed cells with provision for preventing corrosion of terminal connections.

1,130,734. Electric Furnace; W. S. Horry, Niagara Falls, N. Y. App. filed Jan. 21, 1914. Subdivides the current in each phase.

1,130,755. Electric Generator; J. L. Milton, Anderson, Ind. App. filed May 15, 1914. For lighting and ignition purposes on motorcycle.

1,130,775. Wire Finding and Coupling Device; I. J. H. Toffey, Waterbury, Conn. App. filed Aug. 25, 1913. Fishing device attachable to the end of the conductor.

1,130,784. Measured-Service Telephone System; B. D. Willis, Chicago, Ill. App. filed April 17, 1913. Operator can communicate with calling subscriber without removing the calling plug from the jack of the called line.

1,130,808. Battery Well; J. M. FitzGerald, Chicago, Ill. App. filed Sept. 27, 1913. Can be shipped in knocked-down form.

1,130,899. Heat Regulator for Incubators; C. P. Heimbourger, Beardstown, Ill. App. filed June 21, 1913. Thermometer controls controlling magnet.

1,130,901. Telegraph Apparatus; C. Henry, Edgemont, Ark. App. filed Dec. 6, 1913. Sounder with tape-marking attachment.

1,130,904. Bearing for Electromagnetic Sparking Machines; G. Honold, Stuttgart, Germany. App. filed Feb. 12, 1908. Insulated bearing.

1,130,915. Vaporizing Attachment; A. W. Mansbridge and S. J. Nash, Winnipeg, Manitoba, Canada. App. filed March 17, 1914. Heating plug attached to the well of the carbureter.

1,130,935. Connector Plug for Electrical Instruments; F. E. Shailor, Detroit, Mich. App. filed Oct. 25, 1913. Special means for guiding and holding the converter plug.

1,130,949. Rheostat; H. J. Wiegand, Milwaukee, Wis. App. filed Aug. 2, 1912. Disk type.

1,130,969. Circuit Controller; A. H. Fleet, Milwaukee, Wis. App. filed Nov. 20, 1913. For automobile-lighting systems.

1,130,971. Intercommunicating Telephone; W. W. Henry, Wollaston, Mass. App. filed June 19, 1914. All parts of the unit are mounted upon a formed block of insulating material.

1,130,976. Rheostat; A. J. Horton, White Plains, N. Y. App. filed Sept. 9, 1912. For fans.

1,130,977. Safety Device; M. R. Hutchison, West Orange, N. J. App. filed March 28, 1914. For secondary cells.

1,130,985. Thermostatic Electric Switch; F. Kuhn, Detroit, Mich. App. filed April 18, 1913. Bowed member within a tube.

1,130,986. Air Heater; F. Kuhn, Detroit, Mich. App. filed June 28, 1913. Electric; has inner and outer spaced gratings.

1,130,987. Electrical Heater; F. Kuhn, Detroit, Mich. App. filed Jan. 5, 1914. Toaster with sheet-metal frame.

1,130,994. Push-Button or Circuit-Closer; L. C. F. Metzger, St. Louis, Mo. App. filed March 4, 1914. Contacts have a rubbing action.

1,131,006. Electric Signal System; E. A. and H. V. Reynolds, Anderson, Ind. App. filed Nov. 9, 1912. Provides telephonic connection between trains and with dispatcher.

1,131,037. Method of Making Bands from Sheet Metal; S. C. Cary, New York, N. Y. App. filed Dec. 26, 1913. Welds sheets together and then slits the welded sheets into bands.

1,131,060. Electric Heater; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Sept. 25, 1913. Candy-batch heater or warmer.

1,131,063. Portable Magneto-Electric Machine; C. Klemmer, Bisbee, Ariz. App. filed Feb. 19, 1912. Hand-size; supplying current for flashlamp.

1,131,079. Incandescent Lamp; C. E. Pierce, Cambridge, Mass. App. filed Nov. 5, 1913. Non-renewable construction.

1,131,088. Antiseptic Attachment for Telephone Mouthpiece; I. S. Rosenblatt, San Francisco, Cal. App. filed May 13, 1913. Ring of antiseptic material carried by sheet-metal holder.

1,131,098. Line-Testing Switch; J. M. Watkins, Buffalo, N. Y. App. filed April 30, 1914. For localizing short-circuits or grounds on telephone lines.

1,131,104. Efficiency Recorder; M. H. Avram, New York, N. Y. App. filed Jan. 23, 1914. Indicators show work machine should accomplish and that actually accomplished.

1,131,129. Switching Device; D. D. Gordon, Chicago, Ill. App. filed Oct. 5, 1911. Quick-break pendent switch of few parts.

1,131,140. Automatic Switch for Telephone Systems; W. Kaisling, Chicago, Ill. App. filed Jan. 3, 1911. Unit construction; does away with extra release magnet, and wipers are restored by spring tension.

1,131,168. Electric Signaling Apparatus for Ships' Telegraphs and Like Purposes; H. L. Stocks, Kirkcaldy, Scotland. App. filed Oct. 13, 1913. Signals disagreement between engine controlling mechanism and the order indicator.

1,131,174. Electrical System of Distribution; W. A. Turbayne, Buffalo, N. Y. App. filed Oct. 27, 1910. Car lighting.

1,131,175. System of Electrical Regulation; W. A. Turbayne, Niagara Falls, N. Y. App. filed Dec. 23, 1910. Storage battery may act to steady the load on an alternating-current generator.

1,131,176. Automatic Regulator; W. A. Turbayne, Niagara Falls, N. Y. App. filed April 18, 1913. Auxiliary regulator for car-lighting systems.

1,131,187. Self-Inductive Means for Electrical Oscillatory Circuits; G. von Arco, Berlin, Germany, and R. H. Rendahl, Stockholm, Sweden. App. filed Jan. 29, 1910. Wireless telegraphy.

1,131,189. Joining Lamp Filaments to Current-Supply Wires; E. Weintraub, Lynn, Mass. App. filed Oct. 27, 1909. End of filament embedded in fused boride.

1,131,190. Production of High-Frequency Currents; E. Weintraub, Lynn, Mass. App. filed June 18, 1910. Involves use of mercury arc. (Fifty-two claims.)

1,131,202. Electric Indicating System; J. H. Boyden, Glenn Dale, Md. App. filed Oct. 2, 1906. For indicating positions of switches, etc.; no electric contacts.

1,131,216. Transmission Line; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 11, 1912. Prevents development of oscillations.

1,131,218. Electrically Controlled Brake Mechanism; E. H. Dewson, New York, N. Y., and W. V. Turner, Edgewood, Pa. App. filed May 9, 1910. For effecting simultaneous action of the triple valves.

1,131,219. Electropneumatic Vent-Valve Device; E. H. Dewson, New York, N. Y., and W. V. Turner, Edgewood, Pa. App. filed May 9, 1910. For venting train-pipe pressure pneumatically or electrically.

1,131,234. Ray Tube; E. H. Grube, Chicago, Ill. App. filed Sept. 8, 1913. Cooling medium is discharged against anode.

1,131,237. System of Distribution; L. A. Hawkins, Schenectady, N. Y. App. filed March 11, 1914. Including vapor rectifier.

1,131,244. Time Indicator; W. M. Jeffreys and W. H. Creahen, Youngstown, Ohio. App. filed May 17, 1912. Embodying a master clock.

1,131,249. Retaining Ring for Dynamo-Electric Machines; E. R. Knight, Norwood, Ohio. App. filed May 1, 1909. Split-ring construction for locking laminas in position.

1,131,250. Telephone-Reinforcing Circuit; C. D. Lanning, Boston, Mass. App. filed Dec. 26, 1905. Operatively related by undivided series connection to the line and free of bridge connection therewith. (Forty claims.)

1,131,251. Means for Controlling Direct Currents; C. D. Lanning, Boston, Mass. App. filed May 29, 1912. Auxiliary means co-operate with the primary means to accentuate the undulatory form of the current.

1,131,258. Transformer; L. C. Nichols, Milwaukee, Wis. App. filed Feb. 28, 1910. Air or ventilating passages cool the insulating fluid.

1,131,278. Automatic Supervision of Service in Hotels and the Like; H. W. Skinner, Maywood, Ill. App. filed July 5, 1913. Signal displayed when attendant unlocks door by service key.

1,131,282. Constant-Current Rectifier System; C. P. Steinmetz, Schenectady, N. Y. App. filed May 23, 1905. Embodying use of mercury arc.

1,131,292. Vapor Converter and Circuits Therefor; P. H. Thomas, Montclair, N. J. App. filed April 25, 1905. Main positive electrodes, a common negative electrode and a supplemental positive electrode.

1,131,297. Indication Circuit for Railway Traffic-Controlling Devices; P. Utne, Edgewood Borough, Pa. App. filed Aug. 13, 1914. For crossovers.

1,131,311. Process of Wire-Tying Bags; A. M. Bates, Chicago, Ill. App. filed Dec. 13, 1911. Electro-welds the wire and then twists to tighten same.

1,131,316. Electrical System of Distribution; J. Bijur, New York, N. Y. App. filed April 7, 1911. Storage-battery charging.

1,131,389. Combined Drop and Jack; W. Leaver, Chicago, Ill. App. filed Dec. 9, 1908. Constructed to permit ready removal of the coil and of the armature.

1,131,399. Outlet Box; J. B. McGinley, Pittsburgh, Pa. App. filed June 23, 1911. Improved form of mechanical connection with the box.

1,131,405. Electric Protector for Automobiles and Similar Vehicles; G. A. Merrill, New York, N. Y. App. filed Feb. 9, 1914. Horn is sounded when attempt is made to steal car or accessories thereof.

1,131,428. Lamp; L. Schepmoes, Hasbrouck Heights, N. J. App. filed May 21, 1912. For car lighting.

1,131,434. Electrical Regulation; W. Snee and J. A. Snee, Jr., West Elizabeth, Pa. App. filed Aug. 28, 1914. Charging storage battery from windmill.

1,135,435. Utilizing Variable Power; W. Snee and J. A. Snee, Jr., West Elizabeth, Pa. App. filed Sept. 16, 1912. Maintains constant predetermined balance between the current output and the available variable power.

1,131,439. Telephone Recorder; E. R. Talley and R. P. Norton, Algona, Ia. App. filed Aug. 25, 1913. Phonographically records incoming calls.

1,131,447. Telegraph Repeater; F. E. Wallace, Franklin, Cal. App. filed Sept. 10, 1913. Has only two electromagnets.

1,131,455. Telephone System; H. M. Wright, Darlington, Okla. App. filed March 12, 1914. Party line with central-station selective switch.

1,131,469. Wiring System; J. A. Cole, New York, N. Y. App. filed March 29, 1912. By which one or all lamps may be put into circuit.

1,131,536. Train-Stopping System; A. S. and H. Mainardi, Paterson, N. J. App. filed Dec. 5, 1913. Embodies conductors on roadbed engaged by brushes on train.

1,131,541. Electric-Lamp Socket; A. H. Nero, New Britain, Conn. App. filed Jan. 9, 1914. Lamp lock of insulated construction.

1,131,549. Self-Scoring Target; M. St. C. Ellis, United States Navy. App. filed Jan. 21, 1911. Hits indicated on annunciator alongside marksman.

1,131,551. Dynamo-Electric Machine; A. A. Price, London, Eng. App. filed July 31, 1913. Armature has a longitudinal spiral movement along its shaft.

1,131,598. Telephone Apparatus; W. M. Byrnes, Vail, Ia. App. filed April 18, 1914. Switch for rural telephones.

1,131,806. Anode for Discharge Tubes; T. H. Gebauer (deceased), Cleveland, Ohio. App. filed May 22, 1912. Facing of the anode is prevented from working loose from the backing.

1,131,609. Process of Cooling Electric Furnaces by Air; H. Magron, Fos, Haute-Garonne, France. App. filed Feb. 9, 1915. Circulates previously cooled air in heat-interchanging relation with furnace while expanding the air.

1,131,614. Electric Motor; A. A. Radtke, Chicago, Ill. App. filed Dec. 12, 1910. Solenoids with cores connected to crank on motor shaft.

1,131,624. Telephone Apparatus; J. Erickson, Chicago, Ill. App. filed Nov. 12, 1906. Insures release of the automatic switches at the exchange.

13,890 (reissue). Manual-Call-Distributing System; J. H. Levis, Jr., Rochester, N. Y. App. filed Aug. 31, 1914. (Original patent No. 1,100,749, dated June 23, 1914.) Secures more rapid and uniform service. (Sixty-three claims.)